VOL. LXXIX. No. 2015. [All Rights Reserved.] JULY 7, 1916. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE (INCLUDING INDEX) FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 2s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 21, Rue de la Banque.
Telegraphic Address: "Ageekay, London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

MOULDED INSULATORS
Of all Descriptions.
LITHOLITE, Ltd.,
55-57, Hackney Grove, London, N.E.

FURNACES for WHITE METALS, &c.
(Hall's Patents),
Without Oxidation. Automatic Heat Control. Enormous Saving in Residue.
Easy payments arranged in special cases.
Monometer Manufacturing Co., Ltd.,
22, Whitehouse St., Aston, BIRMINGHAM.

"FIVE IN ONE"
INDUCTION MOTORS.
WRIGHT & WOOD, Ltd.,
HALIFAX.

RALPH NEAL,
Maker of Presses, Press Tools and Punches of every description for Electrical and Mechanical Engineers.
Blanks, Washers, Press Piercings, Die Stampings in Steel, Brass, or any Material, for the Trade.
LABELS & NAME PLATES A SPECIALITY.
49 & 50, PERCIVAL STREET, LONDON, E.C.
Telephone—4948 Central.

BROOK MOTORS.
See Advertisement, Sup. 30.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

TAYLOR & CO.
MICA & MICANITE
Speciality :—Plates for high resistance.
TELEPHONE :—CENTRAL 4575.
40, HATTON GARDEN, LONDON, E.C.

DIAGRAM PLATES,
Switchboard Labels, Name Plates, Instruction and Address Plates, Advertising Novelties, Club Badges, Checks, Tokens, Blanks, Die Stampings, Dies, Press Tools, Punches, and Cutters.
RELIANCE Engraving Co., Ltd., CHISWICK.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

Have your Feed-Water Tested Free of Charge, by the . . .
"ECLIPSE" BOILER COMPO CO.,
6, Bristol Bridge, Bristol.
SOLE MAKERS OF INFALLIBLE COMPO FOR PREVENTING AND REMOVING INCRUSTATION IN STEAM BOILERS.
AGENTS WANTED.

COOPER HEWITT LIGHT.
24 hours' daylight. Write for List No. 273.
THE WESTINGHOUSE COOPER HEWITT CO., LTD., 60, York Road, London, N.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, Sup. 27.

CONNOLLY BROS., Ltd.,
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co.
2 & 4, GLOUCESTER ST., CLERKENWELL, LONDON, E.C.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

INSULATING - - BEADS - -
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

CABLES AND WIRES.
SWITCHBOARDS.
ARC LAMPS.
JOHNSON & PHILLIPS, LTD.,
CHARLTON, LONDON, S.E.

AIR COMPRESSORS & VAC. PUMPS, Desiccators Sets.
NORMAN DICKSON, PRINGLE & Co.
Cable Pumps & Impregnators.
25, Victoria St., Westminster.

LARGE STOCK KEPT FOR QUICK DELIVERY
SHUNT REGULATORS,
MOTOR STARTERS and all classes of Resistance Work.
The SOLENOID REGULATOR Co., Highgate Sq., Camp Hill,
Telephone: Midland 583. BIRMINGHAM Telegrams: "Solenoid, Birmingham."

BLANKS. PIERCING.
STAMPINGS
METAL.
HAROLD, HARLEY & Co.,
Harley Works, Beckton Road, London, E. 'Phone: East 1300.

STONE'S ELECTRICAL INSTALLATIONS for RAILWAY CARRIAGES.
50,000 COACHES EQUIPPED ALL OVER THE WORLD.
J. STONE & COMPANY, Ltd.,
Deptford, London.

THERMIT, LIMITED,
675, COMMERCIAL ROAD,
'Phone: EAST 4157. LONDON, E. 'Grams: "Fulmen, Step, London."
PATENT
Alumino Thermic Welding Process.

VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE, KINGSWAY, LONDON.
Send for Stock List of Motors ready for delivery.

INGLEBY & Co., LTD.
ELLAND ROAD, LEEDS.
MOTORS
FOR DIRECT AND ALTERNATING CURRENT
Tel. 378
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xxiv.

Foster Metal Drawn Wire Lamps

In these times people want to reduce their expenses, and for the user of electric light — be he householder, shopkeeper, or factory owner —there is no better way of keeping down lighting expenses than by using Foster Drawn Wire Lamps.

No lamps are more durable, consume less current, or last longer than Foster's. They are Britain's best. We shall be pleased to quote you.

Foster Engineering Co Ltd

Works & Stores: WIMBLEDON, London SW
Telephone: Wimbledon 1800 (3 lines).

BRANCH OFFICES:
BELFAST—4, WARING STREET.
BIRMINGHAM—104, NEWHALL ST.
NEWCASTLE-ON-TYNE—COLLINGWOOD BUILDINGS.
GLASGOW—67, WATERLOO STREET.
LIVERPOOL—1/3, STANLEY STREET.
MANCHESTER—78, KING STREET.
SHEFFIELD—9, NORFOLK ROW.

CONTROLLER FINGERS
WITH REVERSIBLE RENEWABLE TIPS.

Telegrams: "Efficiency."

ANY TYPE OF FINGER CAN BE ADAPTED.

Send us an old sample finger and we will quote you for fingers of our type.

CLEVELAND METAL CO., LD., Bridge Works, STOCKTON-ON-TEES.

BASTIAN METERS
FOR DIRECT CURRENT ONLY.
Made in ENGLAND with BRITISH CAPITAL & BRITISH LABOUR.

Buy the cheapest and most efficient meter on the market from:
THE BASTIAN METER CO., Ltd.,
Bartholomew Works, Kentish Town, N.W.

TELEPHONES
PATENT. LOUD SPEAKING. WATER-TIGHT.
ALFD. GRAHAM & CO., CROFTON PARK, S.E.
ADOPTED BY THE BRITISH ADMIRALTY, MANY FOREIGN GOVERNMENTS, & THE LEADING STEAMSHIP LINES.
FOR SHIPS, MINES, POWER STATIONS, ETC.

VULCANISED FIBRE.
DIAMOND FIBRE TRADE MARK
In Sheets, Rods, Tubes, and Special Shapes.
Horn Fibre, Diamond Insulation, Press Board, Fuller Board, &c.
DIAMOND STATE FIBRE CO., 57, OLD ST., LONDON, E.C.

THE

ELECTRICAL REVIEW.

VOL. LXXIX. JULY 7, 1916. No. 2,015.

ELECTRICAL REVIEW.

Vol. LXXIX.] CONTENTS: July 7, 1916. [No. 2,015.

	Page
The French Electrical Industry	1
Advance!	2
The I.E.E. and Electricity Supply	2
Rubber	3
The Tramways and Light Railways Association Congress ...	3
Tramway Transit and Comfort: A Plea for the Passenger. by W. T. Robson	3
The Incorporated Municipal Electrical Association, 1916—III	5
Boiler House Design and Operation, by W. W. Lackie (*concluded*)	5
Correspondence—	
60-cycle Transformers on 25-cycles...	7
Decimal Coinage	8
Trade Statistics of Egypt	8
War Items	8
Legal...	10
Business Notes	11
Notes...	15
City Notes	19
Stocks and Shares	21
Market Quotations	22
Metal Market.—Fluctuations in June	23
Electricity on the Farm	23
Electricity Supply in Greenock—Two Years' Growth (*illus.*)	24
S.P.T.: A Finsbury Reminiscence	25
New Electrical Devices, Fittings and Plant (*illus.*)	26
Electric Incubators (*illus.*)	27
Foreign and Colonial Tariffs on Electrical Goods	28
New Patents Applied for, 1916	28
Abstracts of Published Specifications	28
List of British Patents Expiring during 1916 (*concluded*) ...	28
Contractor's Column ... ... Advertisement page	xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1916 EDITION

READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE FRENCH ELECTRICAL INDUSTRY.

OUR French neighbours, like ourselves, have resolved to liberate themselves as far as possible from the undermining influence which German electrical firms exercised, either directly or indirectly, in the French market down to the outbreak of the war. French electrical firms have suffered in the past from a comparative scarcity of labour, and the situation in this respect may become accentuated after the conclusion of peace. The manufacture of electrical apparatus is chiefly carried on in the vicinity of Paris, where formerly labour was fairly abundant, whereas the construction of machinery was carried out generally in the provinces, where a shortage of labour was experienced, and where the time required for the execution of orders was longer than if workers had been available in greater numbers. Apparently the establishment in the provinces of most works for the production of heavy machinery was originally prompted by the desire to secure cheaper sites, lower taxation, and lower wages than in the Capital, but it is a question whether the commercial results have justified that course. On the other hand, and apart from the mechanical engineering works in operation in the neighbourhood of Berlin, it has to be borne in mind that two of the largest electrical groups in Germany are concentrated in the Capital, and they have certainly found great financial prosperity in that district, despite the prevailing rates of wages, taxation, and the great distance which separates them from the centres of production of raw materials.

A little light concerning French hopes and intentions for the future is shed by the annual report of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. Without concealing the fact that formidable economic and social problems will arise after the war, the report expresses confidence that victory will bring about a rapid expansion of the national industries, and particularly of the electrical branches. But in the commercial struggle, as in the case of the war, it will be necessary to fight with equally efficient methods. To definitely evict German industry from the French market and to compete with it in the markets of the world, it is considered necessary for the French works to increase their productive capacity, to improve their plant and machinery, and to adapt them in such a manner that they will be able to make up for the deficiency of labour by adopting bulk production of standard types, and to pursue a vigorous commercial policy in the opening-up of new markets. The realisation of this programme will require large financial resources. In this connection, the formation is announced of a Chambre Syndicale des Constructeurs of heavy electrical machinery, which will examine and solve the problems of this important department of the industry, and is in complete agreement with the Syndicat Professionel des Industries Electriques which groups all the specialities of electrical manufacturing.

M. Charles Laurent, chairman of the French company, at the recent meeting stated that there was no doubt that at the conclusion of hostilities a great demand would arise in regard to the applications of electricity, and that it was necessary to make preparations at once for coping with it. The French electrical industry henceforward would have to supply articles that competitors across the Rhine had formerly succeeded in placing on the French

market, and must also render itself capable of competing with them in the foreign markets. It was admitted that the task would be a hard one, and that individual efforts would be inadequate unless they were energetically co-ordinated. Germany had shown what could be obtained from a solid industrial cohesion, and the French would also organise their productive resources without, at the same time, abandoning their capacity for individual initiative. In this connection, M. Laurent mentioned that the views which he had exchanged with the most important firms permitted him to state that this necessity had been unanimously recognised, and the recent constitution of the Chambre Syndicale des Constructeurs marked a decisive step towards an understanding which could not fail to be fertile, and which would complete the work already undertaken by the Syndicat Professionel des Industries Electriques.

It is satisfactory to learn that a re-awakening of national energy and the spirit of enterprise has become manifest in France, and as the economic life of the country is resuming a natural course a progressive expansion is proceeding in regard to orders for peace purposes, quite apart from the exceptional requirements of the Army. The task confronting the French electrical industry, as previously mentioned, will be difficult to solve. But with the cessation of hostilities, there seems no reason for doubting that sufficient financial support will be forthcoming to place the French works in a position which will render them independent of enemy countries and, at the same time, contribute largely to the future prosperity of the country.

Advance!

The past week has been one of great events. All hearts and prayers are with the brave Forces who are so gallantly and heroically fighting to redeem the Liberty of Europe. God speed their efforts! While these stirring events are in progress, steps are being taken at home to deal with some of the problems that will follow when Victory has been won. The Government has, through the Board of Trade, drafted a Bill bringing munition workers under the provisions of the unemployment part of the Insurance Act, with the object of minimising some of the inevitable consequences of demobilisation and reduced war munitions activity. Mr. Asquith's Reconstruction Committee of the Cabinet, which is considering after-the-war problems of every kind, has issued an invitation to all who have any suggestions to make on the subject to submit them, so that the nation may do its utmost to face an unparalleled situation. The House of Lords has allowed the appeal in the celebrated Continental Tyre case, and last, but by no means least, the President of the Board of Trade has appointed a further Committee to make preparations concerning the problems of trade. Each of the foregoing subjects is worthy of considerable attention in our pages this week, but we must forego the privilege owing to the demands upon both time and space in these exceptional days. While the Forces at the Front are putting forth all their energies to win the war in the field of blood, thinking and practical minds must prepare for the days that, we trust, will not be long deferred. Some of the problems are so complex that they will call for deep inquiry and anxious thought for months to come, for we are faced, indeed, with a vastly altering national situation fraught with infinite possibilities. The Economic Conference, which arrived unanimously at such important recommendations, carried its work through with marvellous expedition, and the Nations must not be less expeditious in facing the details that necessarily follow upon the acceptance of the principles laid down in those conclusions. We trust that we shall be justified in our hopes that matters will now move more rapidly in both the military and the economic spheres, and we hope that in these preparations for the period of Demobilisation, Reconstruction, and Trade Security there will be energetic action and, as far as possible, unity of spirit. The new Trade Committee is, to our minds, as important as any that has yet sat to consider pressing problems. It is to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts, and to prepare a detailed scheme for that purpose. The Committee is composed of bankers and other financial authorities, as well as industrial and commercial men, to whom the subject of industrial finance is no new one. The evidence should be ready at hand, for the subject has been discussed almost to death for many years. We look to this Committee to go a long way to assist British industry, which unquestionably has been handicapped in the past by competition with the industrial banking systems of the Teuton.

The I.E.E. and Electricity Supply.

The announcement which we make in our "Notes" to-day, that the Council of the Institution of Electrical Engineers has appointed a Committee of seven members to consider the present and future of the supply of electricity in this country, in the light of Mr. Williams's paper and the discussions which followed it, will be read with pleasure by all who have the interests of the industry and of the Institution at heart. The announcement is somewhat belated, as the Committee was formed on June 8th—the day before we urged the Council not to miss the opportunity of placing the Institution in its rightful position at the head of this great movement, lest others should forestall it. We trust that no time will be lost in pressing on with the matter, which is of urgent importance.

In our issue of June 23rd we drew attention to the suggestion put forward by Mr. H. S. Ellis, in his paper read before the I.M.E.A., that a committee of members of that Association should be formed "with power to co-opt members of other scientific societies," to investigate the state of electricity supply in this country; the formation of such a committee was in fact decided upon on June 21st, at a joint conference of the Council of the I.M.E.A. and representatives of the power companies, and the President made a statement on the subject on the following day. There are, therefore, two Richmonds in the field, and it will be observed that our renewed warning to the Institution with regard to the leadership of the industry was fully justified. But we are certain that there is no desire on the part of the I.M.E.A. to usurp the position, provided that the I.E.E. is disposed to take vigorous action in the interests of progress and reform. Whether the two committees will eventually combine, or hold joint sittings, or whether they will agree to divide the field of labour between them, remains to be seen; on this point we have no official information. It is obvious, however, that overlapping should be avoided. On the one hand, we have the municipalities and the power companies jointly representing the supply undertakings of the country; on the other is the Institution, which represents, or ought to represent, not sectional interests but the whole of the electrical engineering profession and industry, and is in a position to consider the subject on the broadest lines. It would seem that there is room for both parties to work harmoniously together towards the development of the supply industry on a sounder basis.

In the absence of additional information we can make no further comment on this particular sub-

ject; but we take this opportunity of appealing once more to the Council of the I.E.E. to keep its members and the public better informed as to its doings. There has been a distinct improvement in this respect of late, but as a rule the items which appear on the last page or two of the I.E.E. *Journal*, whilst of the kind we advocate, are altogether too absurdly meagre to fill this want, which, we can assure the Council, is widely and deeply felt amongst the members.

Rubber.

Admittedly the market for crude rubber has been anything but encouraging to the producing estates, but, as already hinted in these columns three weeks ago, there is not much hope of better things for another few months, or until towards the autumn, when market conditions may possibly improve, though the outlook presents many uncertainties. Much depends, of course, on the progress of the war in connection with which huge quantities of the product have been absorbed within the last twelve months or so. The United States will probably continue a heavy consumer, yet indications in that quarter have become distinctly reactionary, so that future needs are a matter of considerable uncertainty. Owing to the critical state of shipping during the war, the larger trans-Atlantic manufacturers have made probably full provision against prospective requirements. The stocks still available across the Atlantic are now doubtless being eaten into steadily, but new enterprise is, at the same time, kept within more conservative limits, and it is hardly likely that any market expansion of new buying will take place for an indefinite period. The general feeling of weakness, moreover, is against any development of the demand beyond actual needs. In the second half of June very considerable quantities of plantation rubber were disposed of, consumers who were short having replenished stocks to some extent at the comparatively low prices ruling, but there is still plenty of rubber awaiting disposal, though arrivals lately have been less numerous through shipping delays or other drawbacks.

The price of fine plantation grades has fluctuated down to about 2s. 4d. per lb., this being about the lowest figure seen since the end of the third quarter of last year. There is just a possibility that the weakness may become accentuated, despite the fact that the market seems to display rather more resistance. The set-back from the highest registered earlier this year represents not much less than 2s. a lb., which is a rather serious matter for the estates, whose profits are bound to be curtailed to an extent which must lead to renewed efforts being made for more economical working in the interest of their shareholders. It is rather peculiar that developments as regards prices during the last three months have been pretty similar to those witnessed within the same period two years ago, or just prior to the outbreak of the war, the advent of which had a paralysing effect upon the demand. The market subsequently had frequent fluctuations, but fell only slightly below 2s. for No. 1 latex, and after rallying up to about 2s. 6d. dropped again late in 1914 to the lower figure mentioned. With the turn of that year, however, a steady upward movement ensued. History may possibly repeat itself, owing to the unsettlement which must be expected to continue pending a conclusion of the war. It remains to be seen, however, whether the price will break to under 2s. a lb., as happened in 1914. The outlet for rubber is, after all, still quite good, and the present low prices tend to restrain producers in their forward sales. It is rather more difficult to place orders for distant deliveries, even at a notable premium, notwithstanding the ease with which spot purchases can be made.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION CONGRESS.

On Friday afternoon last, the eighth annual congress of the Tramways & Light Railways Association was held in London, being restricted to a short meeting at the Westminster Palace Hotel, where, after some introductory remarks by the chairman, the Hon. Arthur Stanley, M.P., on the report and accounts, a paper by Mr. W. T. Robson (Southampton) on "Tramway transit and comfort: a plea for the passenger," was read and discussed, the members being subsequently conveyed in special 'buses to the London General Omnibus Co.'s Training School at Milman Street, Chelsea. Here, under the guidance of our old friend, Mr. Blain, Operating Manager of the L.G.O. Co. and the Underground Railways, the methods employed by the company in training, equipping, and feeding its staff were explained and demonstrated to the visitors, whose attention was fully occupied until such time as it became necessary to adjourn to the Trocadero Restaurant for the annual dinner, which was held during the evening.

The Hon. Arthur Stanley (Chairman), in opening the meeting and welcoming the visitors, referred to the necessarily restricted programme.

In regard to the report and accounts, both revenue and expenditure were on a reduced scale during the year, but a revenue balance of £126 remained, which, added to funds in hand, left them with £430 to carry forward.

He referred in sympathetic terms to the deaths of Sir Charles Rivers Wilson, their first president, and Mr. Robert Hammond; also to the severe illness of Mr. A. L. C. Fell, from which he is now happily recovering.

One of the most serious problems which had confronted them was the loss of employés; on some systems 40 and even 60 per cent. of the staff had joined H.M. Forces, and great difficulty was experienced in filling vacancies.

Female conductors were very generally employed now with satisfactory results, and in some cases women drivers were employed on easy routes.

Satisfactory arrangements had been made with the manufacturers in regard to delivery of steel tires, but the rail question was a more difficult one.

In regard to the effect of paper shortage on tickets, the difficulty had been generally overcome by using smaller tickets.

In regard to Finance (No. 2) Act, 1915, and excess profits, the Association had applied to the Board of Referees on behalf of company tramway members for an increase of the statutory percentage from 6 to 12 per cent., which is considered fair in cases of limited tenure; in regard to the Local Government (Emergency Provisions) Act, 1916, Section 20, dealing with consent necessary for establishing new 'bus routes, &c., the Association would have preferred a general Act applying to all users of the roads, and apportioning the burden of taxation fairly amongst them.

It was hoped that as the result of joint efforts, a standard method of assessing income-tax on motor 'buses would be obtained, similar to the tramway standard.

On their behalf, he congratulated their late Vice-Chairman, Mr. James Devonshire, on his appointment to the Board of Trade Electrical Committee, and, as the Council thought that the tramway industry should be represented at the inquiry now being held by that Committee, he proposed that Mr. Stephen Sellon should be invited to give evidence on their behalf.

The report and accounts having been approved, Messrs. A. H. Beatty, Bulfin, Vincent Edwards, A. W. A. Chivers, H. M. Sayers, and G. M. Harriss were elected to fill vacancies on the Council caused by members retiring, whose period of office had expired.

The Chairman then called on Mr. W. T. Robson (Southampton) to read his paper, an abstract of which and the discussion follow.

Tramway Transit and Comfort: A Plea for the Passenger.

By W. T. Robson.

The object of this paper is to endeavour to point out that the passenger has not always been sufficiently considered in the prosperous times of the past; and in making plans for the future it might be well to consider how his comfort may be increased, because by such means he might be induced to ride more often.

Just before the outbreak of war I rode down a steep hill on a certain tramway system in the upper saloon of a car, and the condition of the track, together with the condition of the car, turned that ride into a species of nightmare.

The sum of roughly £20,000 had been allocated to the relief of rates out of the surplus profits of this undertaking in

the last four years. A small proportion of this amount would have been much better spent in track renewals.

It is surprising that so many systems have not done more to abolish hammered joints, considering the facilities which exist in the way of welding. The impossibility of obtaining new rails at present should only serve to wake us to the necessity of increasing the life of existing track by means at our disposal.

The question of rail groove cleaning has never received the consideration due to this method of reducing noise. One hopes that in the near future vacuum cleaning will bring about the desired result.

It is, however, in the direction of rolling stock that the hopes of a passenger desiring a more comfortable ride must principally be centred; we are mounting our cars on practically the same truck as we did 15 years ago, and, although we may add various devices in the hope of gaining flexibility and radial action, it must nevertheless be admitted that a really comfortable riding truck is not yet an accomplished fact.

To all intents and purposes, the hand brake is the same as on the horse cars 20 years ago; the various devices of inserted gearing have not improved things from the point of view of those travelling in the car. An interesting experiment is being made at Huddersfield at the present time, in the nature of a brake drum keyed on an extended armature shaft in the same way as the pinion, with a Ferodo-lined band-brake operated in the usual way by means of the brake spindle. The advantages of such a brake are obvious, and in actual practice it is proving a great success. There would appear to be quite a movement in the direction of improved brakes at the present time, and similar efforts should be applied to the whole truck.

The longitudinal seating of the usual British car, and the wearisome cry of "Move up, please," or "Sit closer together, please," makes one wonder why the use of cross-seats in the lower saloon has never become more common. The advantage of being able to tell at a glance if any seat is available is very obvious A 24-passenger cross-seat car holds 24, whereas on a longitudinal-seated car the best conductor often is unable to induce, say 22 passengers, to move up and make room for 24. There is infinitely more comfort in facing the direction in which the car is travelling and in being able to look out of the window without twisting one's neck. I would warmly recommend this type of seat to those who are considering the question of new rolling stock. The question of gauge is not an obstacle, as cross-seats have been most successfully adopted at West Hartlepool, a narrow gauge system. Before leaving the question of seating, is it not time that the uncomfortably hard wood seat was superseded by something more comfortable to sit upon?

The question of providing adequate ventilation without undue draught has long been one of the problems of tramway management, and it is quite evident that ventilators should be fixed and not subject to the whim of any passenger. The best method is to arrange the ventilator windows to open outwards on a quadrant, in the direction in which the car is travelling.

Experiments have been made with induced draught by means of a fan driven from the axle, and there would appear to be no reason why this method should not be adopted with success.

It is evident that any arrangement whereby a passenger may alight from the near side of the front platform would both add to his comfort, and also make the conductor's duties easier. It would be interesting to hear the experience of Newcastle and other places where experiments in this direction have been made. From the passenger's point of view it is a grievance that, after taking a seat at the front of the car in order to leave room for those entering after him, he should be compelled to fight his way back to the rear in order to alight.

A uniform finish, in a car body, in teak or oak is not nearly so attractive as a contrast afforded by, say, oak and mahogany. The modern car should have rounded corners without mouldings and dust-traps; the end panels might well serve as frames for attractive photographs, displaying the charms of the district through which the cars run, confined, as far as possible, to views at the extreme ends of the routes, costing the exploring passenger the maximum fare to get there.

It is not easy to understand why the top saloon is often so much more uncomfortable and unattractive than the lower one. An interior finish of alternate light and dark matchboard with sashless lazy-tong windows and tip-up seats, allowing a clear floor for cleaning, with a row of ventilator windows to match those in the lower saloon, would give a wholesome attractive effect, and would please the ordinary passenger as well as "drawing" the man who boards a top-covered car in order to have a comfortable smoke.

A year's experience of south country tramways makes one wonder if the British principle of a double deck closed car has been too closely followed, at any rate in the south; the extraordinary popularity of a car on the Blackpool toast-rack principle, adopted at Southampton, certainly leaves no room for doubt as to the preference of the travelling public.

It is hardly reasonable to expect intending passengers to wait in wind and rain, and pavement verandahs are greatly appreciated.

The war has given us a fine opportunity of getting rid of certain unnecessary stopping places, and it will be found that the travelling public as a whole are quite pleased to find the cars getting along quicker. Many systems suffer from too many stopping places, and the excuse for remedying the evil which now offers itself is too good to miss.

It is somewhat deplorable, especially from a passenger's point of view, that on many systems some purely local obstruction should have been allowed to govern the design of the whole of the car service for future ages. Quite a number of tramway authorities have had to reduce headroom to the smallest possible limit because of one wretched bridge or archway.

Large and awkwardly-shaped parcels are frequently a scurce of irritation to passengers; the best way of dealing with this evil is to charge for parcels beyond a certain size and weight, and insist on them being placed on one or other of the platforms.

The sale of books of tickets has recently met with so much success in certain towns that the subject ought not to be ignored in considering the point of view of the passenger.

A railway time-table at each end of the car is often very useful, and large illuminated route numbers are a great boon if the system is large enough to warrant them. Someone once said that tramway passengers were composed of all classes of humanity, mostly fools, but I venture to suggest that after nearly 20 years of electric traction, the travelling public are entitled to many things which on the average system they do not get, particularly in the nature of a more comfortable ride, less noise, easier exit, and less petty annoyance.

Mr. A. V. Mason, in opening the discussion, said that on his tramway routes women could drive cars if the latter were equipped with air-brakes, but not with ordinary brakes. He had experimented with ball bearings on one car, and found that while energy was saved, as compared with ordinary bearings, when running light, the reverse was the case when loaded. He agreed as to the advantages of cross seats, the "toast-rack" car having proved popular.

Mr. A. W. A. Chivers thought that the average tramway passenger had much done for him that he had not paid for, and he was afraid that it would not pay to incur much further expense. Tramway trucks had been considerably improved since the horse car days, and it might be noted what excellent riding was obtained on sleeper tracks; the rigid street track was no doubt responsible for hard riding experienced in towns. He had been struck by the efficiency of the drum brakes employed on 'buses, and in regard to the Huddersfield tramway drum brake, said he would have thought that with the high speed of the armature shaft, the coefficient of friction would be very low. For short-distance dense traffic, fare collection was much facilitated by the longitudinal seat arrangement, and it was easier for the passenger to signal to the conductor. Seats were generally good enough, but ventilation was often bad in double-deck cars, and could be improved by a high roof.

Mr. Ernest Hatton (Newcastle) said that as a result of their experience he thought they would eventually alter all the Corporation cars to the front exit type. Newcastle was the first city to use all cross seats in its cars, but in altering the design for front exits, the seating was modified and longitudinal seats fitted near the doors, to avoid obstruction; he agreed that it was easier to collect fares with longitudinal seating. Four front exit cars were running; there was only room for one person at a time to get off, and not a single accident had occurred so far, which condition, he hoped, would apply later to other reconstructed cars, and thus reduce compensation. It was not his experience that double-truck cars did more damage to the track than single-truck cars.

Mr. C. W. Shepherd (Edinburgh) considered that there was very little in the question of passengers' comfort. Regular meals were a necessity for female conductors, or they would break down in health.

Mr. F. Bland disagreed with the author's suggestion as to great difficulty in obtaining materials such as tires, axles, and rails; if members would apply to his firm they would obtain assistance. Tokens would be better than books of tickets, as the latter were easily destroyed, but some inducement must be held out to passengers to invest in tokens.

Mr. Edwardes (S. Lancs. Tramways) emphatically condemned modern tramway truck design, and asked why solid steel rather than forged or pressed side frames should be used. His experience with 40 or 50 cars with built-up side frames had been very satisfactory, and he thought there was scope for some body to take up the question of car design on an engineering basis. While rails and tires were obtainable, they were prohibitively expensive.

Mr. Stephen Sellon considered that they only wanted plenty of money and comfort would doubtless induce travelling. Opinion seemed to favour longitudinal seats. He could not quite agree that temporary repair work should be condemned when new work was so costly.

Mr. L. E. Harvey (Ilford) said his experience with pressed steel trucks was that they were always under repair, and he regretted that most of his cars were fitted with them. Tokens were used at Ilford and much appreciated; a discount was allowed to purchasers.

Mr. Hame (York) said he used trailer cars to a limited extent; they were satisfactory and would be much more used

in the future, as also would the air brake. The drum brake, he thought, would result in many "flats" remaining on the wheels, which the tire brake ground out.

Mr. BENEDICT asked why, if there was such a shortage of paper, tickets were not collected and returned to the paper makers?

Mr. F. COUTTS (Paisley) thought the sale of tokens at a discount led to fraud as between the employés and passengers, and that this could not, in his experience, be avoided. He asked whether anyone had had experience of "seatless" cars; with such an arrangement an ordinary car would carry 150 standing passengers during rush hours from factories.

Mr. HATTON interposed to mention that it had been proposed at Newcastle to alter cars to the "seatless" type for conveying factory workers in bulk, but they now had longitudinal seats in some cars, and with the wide car bodies used there was space for 40 standing passengers. The seatless car, with a turnstile at each end, had been employed in Trafford Park in its early days to convey Westinghouse employés to and from the Park entrance.

The AUTHOR, in replying, commented on the excellence of the seatless car for moving crowds; it seemed out of place to mention this type of car in a paper urging comfort for passengers. He agreed that if women drivers were employed, air brakes should be used. More comfort must be given to passengers if the great competition of the present day was to be successfully met. As regarded the Huddersfield drum brake, its action appeared to be exceedingly sensitive and rapid, and there was no sticking. He agreed that truck design required overhauling; he could not afford new rails for renewals, and referred to the satisfactory result of welding old joints.

The afternoon's visit to the Milman Street training centre of the London General Omnibus Co. was of the greatest interest to those taking part in it. A site area of some 30,000 sq. ft. is occupied by a training yard for driving, class-rooms in which the drivers are initiated into the internal mysteries of engines, gear boxes, brake mechanism, &c.—actual sections and parts being used for demonstration—and in which the conductors (perhaps we should say "conductoresses" in these days) are taught to handle the punch and ticket, and generally to perform their future duties. In this connection a kinema hall, to seat 400, is provided, in which educational films are shown illustrating actual service working, points in connection with the avoidance of accidents being discussed during lectures at the same time. The average period of instruction is 14 days for a conductor and 28 days for a driver.

A mess-room is provided where learners can obtain food at practically cost price, and the company's clothing store is also situated on the site, 20 stock sizes being found to meet practically the whole of the requirements of the 10,000 uniformed staff.

After a general tour of inspection, the visitors were entertained to tea by the L.G.O. Co., at the conclusion of which Mr. Blain gave an interesting résumé of the objects which it was hoped to achieve at the depôt, and of staff matters generally.

After pointing out that the withdrawal of men on the outbreak of war and since had emphasised the usefulness of the training depôt, he mentioned that 18 mess-rooms connected with garages were also controlled from there, and that it was hoped to establish both waiting and mess-rooms at the main terminal points later; the influx of female conductors had rendered it necessary to obtain rooms in 200 houses on the various routes.

Some 3,800 drivers were now employed, and 50 per cent. of them had been newly trained in the school.

A very strong feature was being made of the "safety first" movement, and no effort was being spared to educate both the staff and general public in safe methods. There had been a noteworthy falling-off in accidents in recent months despite the more difficult conditions in the streets; accident claims payments had been reduced by 15 per cent. in three years, and since 1910 the number of accidents had been reduced by 68 per cent., to an average of 2.5 accidents per 10,000 miles run. This, he thought, excelled the Boston (U.S.A.) Elevated Railway's record reduction in accidents. They had found the kinema exceedingly useful in training employés how to avoid accidents. About 900 designs for 'bus lifeguards had been submitted to the company, and a standard type of side lifeguard was being fitted, which so far had saved 123 lives; they hoped to obtain official approval of a front lifeguard before long. In carrying out the "safety first" campaign, the daily Press had been systematically used, legends, which could be changed, were placed on 'buses, and recently 250,000 small pamphlets were distributed through the L.C.C. schools. Accidents were analysed and reconstructed, and views made of them for instructional purposes.

Since the war commenced, 13,000 women applicants for employment had been interviewed, and one-third of the company's 'buses was now "manned" by women conductors. There were also 19 female timekeepers and 12 female cashiers. They had only lost 37 women, or 4 per cent., and only 20 gave up because the work was too hard.

Experience showed, moreover, that the work was not too hard for women, and probably owing to the open air life and good food it had been frequently found necessary to refit them with uniforms.

On the subject of cheap meals, provided by the catering department, the annual turnover of the latter represented 2½ million transactions, and gave them an income of £30,000, which met the cost of the food and the necessary staff. [We may add that the charges are exceedingly small, particularly under present conditions.—EDS.]

Mr. Blain gave an interesting percentage analysis of the commodities from which revenue was derived, including 36½ per cent. from meat and 14 per cent. from tobacco.

He felt that some day the whole of the traction people would be gathered into one association, and concluded by expressing the pleasure which it gave the company and himself to have them as visitors.

A vote of thanks having been accorded on behalf of the Association, Mr. Mandelick, Secretary of the L.G.O. and allied railway and tramway undertakings, expressed, in a few words, appreciation of Mr. Blain's work for the company, and incidentally mentioned that it was intended to provide a seat for the conductor on 'buses.

Subsequently the visitors were shown a series of kinema films illustrating the right and wrong way of driving and conducting 'buses, avoiding accidents, &c., the views being taken in London streets and realistically accompanied by bell, gong (when a tramway car was on the film), and hooter, operated by a demonstrator who lucidly explained each film as it was shown.

We cannot conclude without congratulating the company on the splendid work which it is carrying out, and although there are few organisations in this country with the money and means of the L.G.O. and its associated concerns at their disposal who could hope to emulate the thoroughness of the methods employed, yet these are of such value, and have apparently been so successful, that every tramway and 'bus manager could with advantage study them.

The only omission from the interesting series of films (and we commend it to the company's notice) was one which should show "crawling" 'buses (trying to spin out running time) approaching a railway terminus in the evening; if the demonstrator were at the same time to reproduce the remarks of the numerous passengers who have missed their accustomed train by about a minute, a very valuable lesson might be conveyed and a source of grievance removed.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—III.

Boiler House Design and Operation.

By W. W. LACKIE.

(*Abstract.*)

(*Concluded from Vol. 78, p. 729.*)

AN electric power station is simply a factory for the conversion of the chemical energy in coal into electrical energy, and the selection and purchase of fuel are matters of the most vital importance. They depend upon the geographical position of the site relative to the nearest coalfields, and upon the nature of the load. It is a recognised fact that a higher overload duty can be obtained from a boiler fired with good-quality coal with a given draught than can be got with low-grade fuel. It is often more economical to use the best coal because, with the higher overload thus made possible, the number of spare boilers can be kept down to a minimum.

It is now almost universal practice to buy fuel on a calorific basis, but along with calorific value and analysis there are to be taken into account physical properties. Actual boiler

tests must be made with sample truckloads of coal if the best and most economical selection is to be made.

In the Glasgow Corporation electricity department, if any particular kind of coal as delivered is below our previous year's experience of it, then that coal has a decreased figure of value allotted to it against the time when next it will be offered.

A practical test in a boiler specially equipped for the purpose is a very reliable guide to calorific value. A good unit of comparison is the cost of evaporation of 1,000 lb. of water from and at 212 deg. F. or the number of lb. of water evaporated for a pennyworth of coal, including coal and ash handling, which varies with the quality of the coal. The better unit to use for general comparison is the British thermal units per watt-hour, *i.e.*, lb. of coal per unit × B.TH.U. in coal as fired ÷ 1,000. Even this is not perfect, as it does not allow for the variation in load factor between different power stations, but it does enable comparisons to be made irrespective of variations in calorific value. In two of the Victoria Falls power stations the economic result obtained in the way proposed gave in one station 27 B.TH.U. per watt-hour and in another 26. Both of these stations had very high load factors, whereas in many of the London stations, where the lighting load is predominant, the average result is in the neighbourhood of 40 B.TH.U. per watt-hour. Daily samples of coal, as delivered, should be sent to the laboratory of the undertaking for calorific analysis. An assistant, working with a bomb calorimeter, can test 12 samples a day, working from 9 to 1 and from 2 to 5 o'clock. These tests are recorded in a coal test book for reference. As the results of tests obtained by any or all of the methods above referred to are tabulated and arranged, an index of the pits in the coal-field, from which the fuel supply is mainly or wholly drawn, can be compiled, and coal prices as received can be equated on a calorific value basis.

An interesting experiment has been carried out in one of the Glasgow gas works recently. Gas coke breeze or gas coke riddlings were burned successfully on chain-grate stokers with forced draught. A special form of arch had to be built. This breeze can be bought at 20 per cent. the price of coal, and it has a calorific value of at least 60 per cent. of coal. There is a large amount of ash, but the experiment went to show that with intelligent superintendence good results could be obtained with this class of fuel, although the actual output of the boiler was considerably reduced.

Twenty years ago a fireman in a generating station was truly a fireman. The firing of the boiler is now done by operating a rope or a lever. A fire has rarely to be stirred or nursed in any way except by the adjustment of dampers and rate of feed. The substitution of mechanical and electrical machinery for hand labour naturally led to the substitution of the boiler-house engineer for the aforetime fireman. A competent boiler-house engineer is an indispensable adjunct to the boiler-house staff, and the man who knows his business can easily earn the substantial salary which he can command in this capacity. He, of course, trains his own labourers, but the human element should be and is being cut down as far as possible.

Everything possible should be done to obviate wastage of the heat value of coal in the boiler-house before the steam reaches the turbine. A saving of 1 per cent. in the coal bill of the Glasgow Corporation electricity department would this year represent a sum of £2,000.

It is only in recent years that we have come to realise the value of a pound better steam consumption in a steam turbine. We now put a money value on steam consumption per one-tenth of a lb., and stipulate for heavy penalties in the event of failure to comply with guaranteed consumption after allowing a tolerance of 2½ per cent. With an equipment such as has just been described, weekly returns can be prepared giving all the particulars any manager wants to satisfy himself that the plant is being properly handled and is doing its work efficiently. Turbine-room data being also available, a weekly sheet showing running statistics may be easily made out.

In American stations generally considerably more attention is now being given to boiler-house economy, no doubt due to the increasing price of fuel. The workmen in the boiler-house are educated to interpret the various gauges and recording instruments and encouraged to take an interest in improving conditions. The instruments are not to be erected and stored away in the chief engineer's room, but are to be in the boiler-room.

Several very fine records of efficiencies have been attained in America. At the Conner Creek plant of the Detroit Edison Co., which has been in operation for a year, they have two 20,000-KW. turbo-alternators, and each turbine is supplied with steam by two large boilers, each boiler containing 23,500 sq. ft. heating surface. The plant is operating at the present time and producing a KW.-hour on 1.42 lb. of coal, *i.e.*, a little less than 20,000 B.TH.U. per KW.-hour. This shows an efficiency from coal to electrical energy of 17 per cent. The Chicago Commonwealth Edison Co. in their Fiske Street station have two turbo-alternators of 20,000 to 25,000 KW. capacity. Over a whole year's run the coal used per unit of output was 1.92 lb., and the average value of the coal as fired was 10,120 B.TH.U. per lb. This gives an average of heating units in the coal as fired per unit of output of 19,450, and also shows a thermal efficiency of some 17 per cent.

DISCUSSION.

Mr. S. E. FEDDEN (Sheffield), who opened the discussion, said the paper interested him because he was on the eve of a big boiler-house development, which he hoped would not be smaller than 100,000 KW. He could not quite agree with the author's suggestion that the main object in boiler-house design was maximum steaming capacity in minimum space. The first consideration in a prospective design was the load factor at which the boiler plant would work, as this controlled the amount of coal and ash to be dealt with, and the movement and storage of coal and ashes appeared to him to be the main consideration. It was necessary to decide whether to design for the future load conditions of the plant or for the present ones, and to consider how these alternatives would react on one another. The boiler-house was more important than the engine-house, and he was going to employ shift engineers solely to watch the boiler-house, and, eventually, a man to watch ashes, dumping, &c. With a well-covered grate, the riddlings had a calorific value of 9,000 B.TH.U., but when the grate was only half covered, this value dropped to 6,000 B.TH.U. He was quite unable to obtain a greater average than 8 or 9 per cent. of CO_2, and thought this applied to most boiler plants; moreover, he did not see much possibility of getting CO, with the percentage conditions of CO_2 usually obtainable. Data collected at Sheffield on grate maintenance showed that with chain grates using fuel of 14,000 B.TH.U., and burning 25,000 tons of coal, the average cost of maintenance was 2.72d. per ton burnt; with fuel of 10-11,000 B.TH.U. value and burning 37,000 tons, the maintenance cost was only .46d. per ton, and the effect of high calorific fuels on such grates was clearly shown. With underfeed stokers burning 53,000 tons of coal, the maintenance cost came to .57d. per ton burnt, but this cost would increase if there was much banking done. The cost of maintenance for the conveyor using washed coal was 1.18d. per ton handled, but if the coal was unwashed, and contained dust, the figure immediately increased. The conveyor maintenance cost for ash removal, however, worked out at the high figure of 17.76d. per ton handled, and he considered that it would save expense to purchase suction ash plant at the absurdly high prices charged rather than use a conveyor. He had been led to test the ashes dumped from the boiler-house, and found that they had a calorific value of 4,600 B.TH.U.; attention was given to the question, and at the present time this value had been reduced to 3,152 B.TH.U., representing a very considerable saving, which in the case of a 100,000-KW. station would mean a great deal of money. He disagreed with the author's statement that the condensate would show the amount of water evaporated; from experience, he found that 15 or 20 per cent. more steam was generated in the boilers than found its way through the condenser. Tests of the calorific value of soot in boilers showed that this varied from about 600 B.TH.U. in the front tubes to 3,000 B.TH.U. in the economiser, and this might account for some of the heat loss not usually allocated. Since the war commenced he had found a great decrease in the calorific value of the coal sent in, and an increased percentage of ash. An examination of the author's test data for old and new-type boiler plants seemed to show that reduced radiation losses largely accounted for the improved results of the newer plant.

Mr. CHRISTIE (Brighton) said he believed that gas-firing would have a great influence on boiler-house design in the future, and he asked: why not face this problem boldly at the present time? With gas firing the fuel plant could be placed on any convenient site, some distance from the boiler-house, and connected to it by pipes, which would solve the coal storage difficulty, remove dirt and dust from the boiler-house, and, at the same time, enable a by-product recovery plant to be conveniently worked. He was most strongly urging his committee to come to an arrangement with the British Coalite Co. for gasifying 200 tons of coal a day, from which the company would secure the by-products, while the Corporation purchased the gas for boiler-firing purposes.

Mr. S. L. PEARCE (Manchester) felt much sympathy with Mr. Fedden's opening criticism. Space was not the sole criterion in boiler-house design. In connection with the new Barton station of the Manchester Corporation, careful investigation showed that a two-storey arrangement of the boiler-house, with boiler and economisers on one floor, effected a saving in construction cost of 20 per cent. over the three-storey arrangement, due to lighter steel work, &c. It was rarely that a reasonable amount of natural light entered a boiler-house, but the Barton design gave good roof lighting; the question of lighting was bound up with chimney design, and the deposit of ash, soot, &c., from the latter on adjoining roofs. The Barton boiler plant fitted nicely as regarded space with the engine-house, and so long as this was so, he felt that there was little advantage in adopting a three-floor boiler-house. He thought that 20 H.P. per sq. ft. of engine room was rather a high estimate; at Barton, with 20,000-KW. sets, there would be 10 H.P. per sq. ft. The superstation of the future would need large spare capacity. He proceeded to describe the Barton boiler and coal storage arrangements (which were illustrated in the ELECTRICAL REVIEW of January 8th, 1915), and expressed the view that the reciprocating feed pump could not compare with the turbine pump for efficiency. Amongst points to be considered were the division of the coal bunkers to avoid fires, and the separation of ashes from soot, to obtain the utmost value

for them as by-products. A comparison of boiler data for the new Manchester, Chicago, and Detroit stations showed that British practice favoured design for long-continued operation with a considerable margin of capacity.

Mr. JOHN ROBERTS (Durban), president of the recently-formed South African Municipal Electrical Association, after referring to the latter and mentioning that its members were favourably inclined towards federation with the I.M.E.A., said he thought that perhaps attention should have been directed to the self-contained boiler, combining superheater, economiser, feed heater, &c., as a development of the future.

Mr. DAVID WILSON referred at some length to the results obtained in modern water-tube boiler plants abroad, mentioning that it was recognised that for boilers worked at high rates, the water must be pure, and special distilling plants were in use on the Continent to provide such water. The correct efficiency of any well-known boiler type was definitely known, and evaporation was largely a question of combustion; the type of furnace also was largely dependent on the system of draught used. He was inclined to agree that it did not pay usually to burn low-grade fuel, as it required more supervision. The evaporation per sq. ft. of ground area of a modern boiler would come up to approximately 200 lb.

Mr. C. H. WORDINGHAM thought the author's conclusions were generally sound, and pointed out that he had referred to other considerations in design in addition to steam output. The practice of building boiler ranges at right angles to the engine-house necessarily increased the losses in pipe lines, &c. He asked whether there was any real gain in using such big generating units as 50,000 KW., if such difficulty was encountered in the boiler-house design. There was a great future for the gas-firing arrangement referred to by Mr. Christie; he (the speaker) had advocated it in the past, and he believed that some arrangement was possible with the gas people, who were specialists in this branch.

Mr. W. M. SELVEY pointed out that there was not necessarily any relation between the areas occupied by boiler house and turbine room, the latter being more or less an annexe—a small matter when in addition to boiler plant, cooling towers and coal storage were considered. Analysis of the test data led to the conclusion that efficiency had little improved in eight years, but output for space had improved. Further space economy could be obtained by developing boilers of the Yarrow type and increasing grate area. Since the Coventry meeting of the Association, many developments had occurred in grate design, but the older grates, due to improved methods of manufacture, were holding their own against newer types. He had previously advocated an emergency speed for travelling grates with increased draught for meeting overload conditions; it was no good using thick fires for such conditions. With so much capital invested in the electricity supply industry, it would pay to investigate thoroughly the fuel problem at considerable cost. He thought that the idea that the gas interests would assist towards a solution of the fuel problem was a mistaken one, that the future rested with coal fuel, not gas firing, and that the gas turbine had to overcome enormous difficulties before it would become practicable. Co-operation with the coal interests was a possible solution of the fuel difficulty, the return for coal value being given in the form of electrical energy.

Mr. THOS. ROLES (Bradford) said there were very few boiler houses in the country in which a saving of 1 per cent. could not be obtained. The question of increasing grate area required attention, and it would be possible to do this with land-type water-tube boilers if they were lifted. Bradford used the same steam pressure, 200 lb., as 20 years ago, but boiler makers were talking of pressures of 350 lb. per sq. in., and it seemed necessary to decide on the future standard of pressure in view of the boiler plants which would have to be put down after the war ended. He thought the subject should be discussed by those interested. At Bradford it had not paid to install any special coal storage appliances, the coal being heaped on spare ground. High evaporation rates could be obtained by cutting down heating surface as compared with grate area, but it paid rather to have a margin of heating surface. It also paid to buy best coal, as that at 15s. or 16s. a ton was cheaper in use than coal costing 11s. or 12s. a ton.

Mr. BOWDEN (Poplar) said, with reference to the author's 100 lb. evaporation per sq. ft. of ground space of boilers, that at the Poplar works they were getting 113 lb. He stated that steam flow meters were quite satisfactory in his experience, and asked whether the ashes could not be conveyed hydraulically, as in the case of coal at the Hammersmith works. Rotary-type feed pumps were, in his experience, much more satisfactory than reciprocating pumps, not requiring the close attention necessary for the latter.

Mr. GEORGE WILKINSON (Harrogate) congratulated Mr. Christie on his gas-firing proposal, but thought the difficulty would be to get rid of the coke.

Mr. J. P. GREGORY (of the B.T.H. Co.) expressed disdisappointment with the fact that although Mr. Lackie had referred in his paper to the adoption of steam pressures up to 250 lb. in the States, apart from the comments made by Mr. Roles, the whole subject of using higher pressures and superheats had not been discussed. He referred to the importance of giving this matter close study, both from the commercial and from the engineering standpoint, in view of the fact that with increased pressures and temperatures, and the utilisation of steam turbines, it was now possible to obtain very much higher over-all thermal efficiencies than hitherto. He also pointed out that high thermodynamic efficiency on a turbo-generator did not necessarily mean the highest over-all thermal efficiency for the whole generating plant. To make his point clear, he stated that his company decided some considerable time ago to install as an experiment, at their Rugby works, a high-pressure and high-superheat plant. As the result of daily running over a considerable period, this plant had become a permanent part of the company's power installation. The equipment comprised a marine-type tubular boiler, with integral superheater, economiser, induced-draught fan, and chimney, 1,500-KW. Curtis turbo-generator, surface condenser, and turbine-driven boiler feed pump, the latter exhausting into the feed-water tank. Incidentally, the hot air from the alternator was turned into the boiler furnace. The working pressure was 350 lb. per sq. in. (gauge), the plant being designed to give 700 to 750 deg. F. total temperature to the steam. Tests had shown remarkably good results, which would doubtless be published in due course. He noticed that Mr. Lackie referred to a thermal efficiency of 17 per cent. being obtained on one of the large plants in the States, and he presumed that this result was being obtained at pressures higher than those normally used in this country in the majority of the stations hitherto. For comparative purposes, he assumed a boiler efficiency of 80 per cent., which could be modified if necessary when making comparisons with any other boilers. It had been shown at Rugby that with 350 lb. per sq. in. gauge pressure, 264 deg. F. superheat, and 28½ in. vacuum, the over-all efficiency of the unit was 19.12 per cent. A similar unit at 200 lb. per sq. in. gauge, 200 deg. F. superheat, 28½ in. vacuum, would show 17.3 per cent. The comparison would show still more in favour of the higher pressures and superheats adopted on this plant at Rugby if the comparison were made with boiler pressures and temperatures still lower, and more in line with those used up to the present in this country. The speaker also showed that by reducing the pressure from 350 lb. per sq. in. gauge to 200 lb., but retaining the same degree of superheat, *i.e.*, 264 deg. F., the over-all thermal efficiency would come out at 18.5 per cent. In other words, whereas the decrease in thermal efficiency when retaining the high superheat was 3 per cent., by decreasing both pressure and superheat the loss in efficiency was nearly 10 per cent., as compared with the results at the pressure and superheat used on the Rugby plant.

The operation of the plant referred to by Mr. Gregory—which is self-contained in its own power-house—as compared with their normal works plant, has shown a saving of 1 lb. of coal per unit generated. This result is being obtained in spite of the fact that the company's ordinary power-house plant consists of modern engines and turbine plant operating at the usual pressures and temperatures prevalent in the average municipal station.

Bailie W. B. SMITH (Glasgow) mentioned that coal purchases in Glasgow for the various departments were made by a joint committee, and that most surprising and encouraging results were being obtained with low-temperature carbonisation of coal in the experimental plant which the Glasgow electricity department had installed, with a view to adopting gas-firing under boilers. The coke could well be burnt under boilers also, and he believed that the value obtained from by-products would far exceed the cost of gasifying the coal, which had been the drawback in the past.

Owing to the protracted nature of the discussion, in which several other speakers had intended to take part, Mr. Lackie decided to reply in the *Proceedings*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

60-cycle Transformers on 25-cycle Systems.

Referring to the article on 60-cycle transformers appearing in this week's issue, the reason why some transformers will operate on a lower frequency than that they were designed for, is due to their having a large quantity of iron in the cores. When the iron of a transformer is worked below the saturation point, the magnetising current varies directly as the amplitude of the induction wave, but as soon as it is worked over the saturation point the magnetising current and core losses rise to a very high figure. Since the amplitude of the induction wave varies inversely as the frequency, it can be readily followed that when the frequency is reduced, the magnetising current and core losses increase.

Some transformers contain sufficient iron to enable the frequency to be reduced 50 per cent. or more, and still operate with the amplitude of the induction wave below the saturation point, whilst others, containing less iron, if worked under this condition would operate with the amplitude of the induction wave above the saturation point, thus causing the losses to become so excessive that the transformer would burn out even on light load.

D

However, this difficulty can be overcome, owing to the fact that the amplitude of the induction wave also varies inversely as the voltage; therefore, if the frequency is reduced 50 per cent., and the voltage reduced 50 per cent. as well, the induction will remain almost the same.

From what has been said, it follows that if two 60-cycle transformers are connected together in series on the primary side, and in parallel on the secondary side, they will operate quite satisfactorily on a 25-cycle supply, since both the voltage and frequency in this case are reduced by almost the same percentage. In order to enable both transformers to do their rated output, the primary winding of each must be divided into two equal parts and (the parts) connected up in parallel with each other.

W. D. Lovell.

Middlesbrough, *June 26th*, 1916.

[The course proposed in our correspondent's last sentence appears to neutralise the effect of connecting the transformers in series.—Eds. Elec. Rev.]

Decimal Coinage.

In his letter, which appears in No. 2,011 of the Review, under the heading "Decimal Coinage," Mr. Alfred Bridges says: "Yet has he, or any other man, ever seen in modern French currency a centime piece, of which the French 'penny' is a multiple of 10?"

I beg to enclose one centime and one two-centime coins.

I would like to add that these coins, although not in common use, are not by any means a rarity. As a matter of fact, these coins are daily paid out at the French Government cash offices.

Secretary,

Compagnie des Cables Sud-Américains.

Paris, *July 1st*, 1916.

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1915, is taken from the recently-issued trade statistics. The figures for 1914 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1914. £E.	1915. £E.	Inc. or dec. £E.
Rails.—			
From Great Britain ...	8,000	500 –	7,500
,, Germany	140,000	— –	140,000
,, United States ...	—	3,500 +	3,500
,, Belgium	18,000	— –	18,000
Total	166,000	4,000 –	162,000
Steam engines, including boilers, &c.—			
From Great Britain ...	85,000	29,000 –	56,000
,, Germany	13,000	— –	13,000
,, Belgium	4,000	— –	4,000
,, France	5,000	3,000 –	2,000
,, Holland	1,000	2,000 +	1,000
,, Italy	13,000	2,000 –	11,000
,, Other countries ...	—	1,000 +	1,000
Total	121,000	37,000 –	84,000
Electrical machinery.—			
From Great Britain ...	13,000	11,000 –	2,000
,, Germany	2,000	— –	2,000
,, Austria-Hungary ...	9,000	— –	9,000
,, Belgium	1,000	1,000	—
,, United States ...	—	1,000 +	1,000
,, France	2,000	1,000 –	1,000
,, Italy	1,000	1,000	—
,, Switzerland ...	7,000	2,000 –	5,000
,, Other countries ...	1,000	1,000	—
Total	36,000	18,000 –	18,000
Petrol and benzine motors.—			
From Great Britain ...	74,000	19,000 –	55,000
,, Germany	21,000	— –	21,000
,, Italy	15,000	1,000 –	14,000
,, Switzerland ...	35,000	15,000 –	20,000
,, Other countries ...	7,000	— –	7,000
Total	152,000	35,000 –	117,000
Lamps of all kinds.—			
From Great Britain ...	6,000	4,000 –	2,000
,, Germany	14,000	— –	14,000
,, Austria	14,000	— –	14,000
,, France	7,000	5,000 –	2,000
,, Italy	1,000	3,000 +	2,000
,, Sweden	5,000	1,000 –	4,000
,, Holland	1,000	2,000 +	1,000
,, Switzerland ...	—	2,000 +	2,000
,, Other countries ...	1,000	2,000 +	1,000
Total	49,000	19,000 –	30,000
Copper, manufactured.—			
From Great Britain ...	8,000	5,000 –	3,000
,, Germany	26,000	1,000 –	25,000
,, Belgium	3,000	— –	3,000
,, France	17,000	5,000 –	12,000
,, Italy	6,000	1,000 –	5,000
,, Other countries ...	2,000	— –	2,000
Total	62,000	12,000 –	50,000
Scientific instruments.—			
From Great Britain ...	35,000	14,000 –	21,000
,, Germany	13,000	— –	13,000
,, Austria	8,000	— –	8,000
,, United States ...	500	2,000 +	1,500
,, France	9,000	5,000 –	4,000
,, Italy	3,000	1,000 –	2,000
,, Switzerland ...	2,000	— –	2,000
,, Other countries ...	14,500	2,000 –	12,500
Total	85,000	24,000 –	61,000
Other machinery (except agricultural).—			
From Great Britain ...	79,000	39,000 –	40,000
,, Germany	21,000	— –	21,000
,, Austria	2,000	— –	2,000
,, Belgium	6,000	— –	6,000
,, United States ...	35,000	8,000 –	27,000
,, France	15,000	8,000 –	7,000
,, Italy	3,000	4,000 +	1,000
,, Switzerland ...	11,000	1,000 –	10,000
,, Holland	2,000	2,000	—
,, Other countries ...	1,000	2,000 +	1,000
Total	175,000	64,000 –	111,000
Copper, hammered, drawn or sheet.—			
From Great Britain ...	88,000	25,000 –	63,000
,, Germany	15,000	— –	15,000
,, Belgium	2,000	— –	2,000
,, France	7,000	1,000 –	6,000
,, Other countries ...	2,500	— –	2,500
Total	114,500	26,000 –	88,500
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	8,000	24,000 +	16,000
,, Germany	10,000	— –	10,000
,, Austria	2,000	— –	2,000
,, France	5,000	11,000 +	6,000
,, Italy	5,000	3,000 –	2,000
,, Switzerland ...	500	1,000 +	500
,, Belgium	1,000	— –	1,000
,, Other countries ...	1,500	— –	1,500
Total	33,000	39,000 +	6,000
Electric, telegraphic, and telephonic apparatus.—			
From Great Britain ...	35,000	29,000 –	6,000
,, Germany	13,000	— –	13,000
,, Austria	8,000	— –	8,000
,, Belgium	10,000	— –	10,000
,, United States ...	500	1,000 +	500
,, France	9,000	9,000	—
,, Ataly	3,000	8,000 +	5,000
,, Sweden	5,000	1,000 –	4,000
,, Switzerland ...	2,000	3,000 +	1,000
Total	85,500	53,000 –	32,500

£E = £1 0s. 6½d.

WAR ITEMS.

Exports to China.—The "London Gazette" for July 4th contains a further list of names of persons to whom articles may be exported in China and Siam.

To be Wound-up.—The Board of Trade has prohibited the following firm from carrying on business after September 29th, 1916:—

Turner & Burger, 149, Farringdon Road, London, E.C., electrical accessories merchants. Controller: J. E. Percival, 6, Old Jewry, E.C.

Contraband.—The following articles have been added to the list of those to be treated as contraband of war:—

Electric appliances adapted for use in war, and their component parts.

Asphalt, bitumen, pitch and tar.

Felspar.

Export Prohibitions.—The "London Gazette" for June 30th contains further lists of persons or bodies of persons with whom trading is prohibited in Argentina, Morocco, Norway, Netherlands, Spain, and other countries.

Controlled Works.—The addition of a further 339 establishments to those under the control of the Ministry of Munitions makes the present total 3,916.

Finance and Trade: A Government Committee.—The Board of Trade has appointed a Committee "to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts, and to prepare a detailed scheme for that purpose." The Committee includes, as the following list of members shows, Mr. F. Dudley Docker, C.B., who brings a wide industrial financial experience to the Committee table, and Mr. Walter Leaf, who, in addition to being a deputy-chairman of the London County & Westminster Bank, which it will be remembered recently entered into arrangements for assisting Italian industries financially, is a director of two electric supply companies. The remainder of the members are eminent bankers and insurance or other financial authorities. The complete list is:—

The Lord Faringdon (chairman),
Mr. B. P. Blackett, C.B.,
Sir W. H. Clark, K.C.S.I., C.M.G.,
Mr. F. Dudley Docker, C.B.,
Mr. Gaspard Farrer,
Mr. W. H. N. Goschen,
Rt. Hon. F. Huth Jackson,
Mr. Walter Leaf,
Hon. Algernon Mills,
Mr. J. H. Simpson, and
Mr. R. Vassar-Smith.
Mr. Hartley Withers will act as secretary to the Committee.

Salford Electricity Staff.—Of the employés of the Salford electricity department, 71 have gone on active service—13 from the offices, 3 from the stores, 29 from the power station, and 26 from the mains and motor departments. Five have been killed—Sapper E. A. Greenhalgh (draughtsman), Sergeant H. F. Andrews (switchboard attendant), Stoker C. Cooper (fireman), Acting Petty Officer H. Foulkes (labourer), and Private N. Higgins (labourer). Four men have been discharged owing to wounds or ill-health. Mr. T. E. Dransfield, first assistant mains engineer, and Mr. F. Birch, superintendent of the motor department, have recently been granted commissions in the R.N., and are on service with the Fleet in the North Sea.

After-the-War Problems.—The Prime Minister, in March last appointed a Committee of the Cabinet entitled the Reconstruction Committee, over which he presides, to consider and advise upon the problems that will arise on the conclusion of peace, and to co-ordinate the work already done by the departments in that direction. Suggestions from individuals or organisations should be addressed to Mr. Vaughan Nash, C.V.O., C.B., Secretary to the Committee, 6a, Dean's Yard, Westminster.

Sydney Electricity Employés.—The city electrical engineer of Sydney (Mr. Mackay) has reported complaining of the serious inconvenience that has been caused in his department by the fact that 170 of his employés have enlisted. So far he has done nothing to discourage enlistment, but a position of affairs has now arisen which renders further complacency on his part detrimental to the continued efficiency of the electric lighting service. The Lord Mayor has followed up the report by a minute expressing the opinion that the endorsement of the head of the electricity department should be required, subject to the supervision and concurrence of the Town Clerk, in each case where skilled labour is affected by enlistment.

Lighting Prosecution.—William Dix, a cleaner at the York Corporation tramway sheds, was fined £5 at the local police court for having failed to effectively shade lights at the tramway shed. There were about a dozen electric lights burning, and they could be plainly seen through a glass roof. The Bench expressed the opinion that the Corporation should pay the fine.

Exemption Applications.—At the Darlington Tribunal, Coun. J. E. Hodgkin applied for total exemption as a minister of the Society of Friends. His occupation was described as that of a consulting electrical engineer, and most of his time was taken up with religious and philanthropic work. Total exemption was granted.

At the City of London Tribunal last week, Miss V. Dasnieres, of 21, Water Lane, Great Tower Street, E.C., agent for products and electricity, appealed for her brother, Mr. Andre Dasnieres. It was stated that Mr. Dasnieres had been in sole charge of the business for his sister for the last ten years. He was born in England, of French parents, the latter returning to France ten years ago. He was the only man left in the business, which had to provide for various members of the family. Another brother assisted in the business, but he was called up and was now in the Army. Miss Dasnieres stated that the business dealt with the export of chemicals and carbon to France and elsewhere. Postponement for three months.

On the application of the Foots Cray Electricity Supply Co., the manager, Mr. A. Wright, and a cable joiner were given conditional exemption on the ground that the business was in the national interest.

At Oxford, exemption was granted to W. T. Cooke (27), mechanical and electrical fitter and lead burner, on the application of Hill, Upton & Co. It was held that the occupation was a starred one.

An electrical contractor at Leigh, Southend-on-Sea, applied for the third time for exemption. He said that his late partner was engaged on munition work, and the business was run entirely by his own personal exertions. Final exemption until August 1st was allowed.

Whitehaven Tribunal has given until the end of the year to the only employé left with a local electrician.

Conditional exemption has been allowed at Hollingworth to Mr. Walter Powell, electrician.

The proprietress of an electrical business at Southport appealed for a qualified employé who has been in the business for 13 years, and has assisted in its management since the death of her husband. As the man is single, and there are two other experienced men, over military age, in the business, the appeal was refused.

Exeter Tribunal has given three months' exemption to Mr. C. H. Steele (37), electrical engineer, in charge of the local stores of a firm of cable makers and engineers, to enable him to train women electricians.

At Aldershot, Mr. Vertue, of Messrs. Birch & Vertue, electrical engineers, asked for further exemption for Albert Huggard (35), electrical fitter and wireman. Mr. Vertue said that they were the only firm of electrical engineers in the town. They were responsible for the upkeep of about 60 electric motors in factories and workshops. Three months were allowed.

Mr. Mason, manager of the South Metropolitan Tramways, appealed at Croydon for 15 employés. Five, whose ages range from 28 to 33, were each given final exemption until August 31st; the rest were exempted altogether.

Kendal Tribunal has given conditional exemption to Mr. F. Collings, of the Corporation electricity works staff.

Canterbury Tribunal has granted conditional exemption to Mr. F. Lewis (35), chief assistant engineer at the Corporation electricity works, and to Messrs. P. W. Kemp (40), stoker; S. T. Tite (33), shift engineer; and G. H. Lock (38), coal trimmer.

Broadstairs Tribunal has given a month's exemption only to a local electrical engineer.

At Nuneaton, on June 27th, Mr. P. H. Howe (27), electrical engineer, applying for exemption, said that he had been in business for five years, and had lost the only man he had. On condition that the joined the Volunteer Training Corps he was given until November 1st.

At Barnes, exemption was claimed by Mr. W. Ellis, electrical engineer, who is engaged on Government work, and is in business in the town. Asked why he did not obtain a badge, he said that it was hopeless to apply owing to the enormous number of applications sent in. Conditional exemption was allowed.

Burnham (Somerset) Tribunal has conceded conditional exemption to Mr. E. G. Sandford, resident electrical and mechanical engineer to the Burnham Electric Light Co., Ltd.

Three months' exemption has been allowed by the Epsom Rural Tribunal to Mr. W. West, electrician, of Cobham.

At Wimbledon, a local firm of electrical engineers appealed for a wireman engaged on important contracts. The firm's staff has been reduced from 170 to 125, and out of 10 wiremen two only are left. The Tribunal granted two months.

Exemption has been given at Whitby to Mr. J. W. Piggott (56), electrical engineer with the Urban Council.

On the ground of business and family reasons, Watford Tribunal has conditionally exempted Mr. W. E. Warrilow (39), electrical engineer.

Holsworthy Tribunal has exempted Mr. J. W. Gibson (30), manager of the local Gas & Electric Supply Co., on the ground that he is in a certified occupation.

Croydon Tribunal has granted exemption to Mr. E. Staples, chief clerk and accountant in the Corporation electricity department, who served until discharged with the Surrey Yeomanry in Gallipoli, but who re-attested under the new Act, and to 30 employés in the tramway department.

Before the West Sussex Appeal Court, an Eastbourne firm engaged on Government work, appealed for an employé in charge of the electrical plant. The Court dismissed the appeal, but allowed three weeks' grace to allow the firm to apply for the employé to be badged.

Provisional exemption has been allowed to the engineering manager and the engine driver of the Frinton-on-Sea Electric Light & Power Co., they being indispensable to the carrying on of the undertaking.

The Surrey Appeal Court has refused an appeal by a Merton electrical engineer, in charge of the plant at a kinema, who had been refused exemption by the Local Tribunal.

At Aberystwyth, Mr. E. P. Perkins, works engineer and manager, was appealed for by the Electric Light Co. Mr. Perkins said that they now had only two engineers, and it would be impossible to run the works with a less staff than they now had; five had joined the Army. He was granted conditional exemption, together with Mr. G. Pollitt, assistant engineer, in charge of a shift at the works.

At Aberystwyth, the Military appealed against exemption until September 9th granted to B. W. Cheetham, electrician at the Kinema Theatre. The period of exemption was confirmed, but made final.

Before the Caterham Tribunal, Mr. Howard, manager of the works of the Urban Electric Supply Co., appealed for exemption for Mr. A. H. Lewer (26), book-keeper and clerk, and claimed that he should be starred. He stated that the firm had released 300 employés, and every station was short-

handed. The Tribunal gave a month in which to obtain a definite decision as to Mr. Lewer being badged.

At Uckfield (Sussex), Mr. D. W. Freshfield, J.P., claimed exemption for his electrical engineer, Mr. J. Thompson. Exemption was given until December 31st, on condition that the residence remains a hospital.

Exemption until October 1st has been conceded to Mr. C. Gear, electrical engineer, engaged at Normanhurst Hospital by Viscount Hythe.

At Dartford, renewed exemption was claimed by Mr. E. E. Beaver, for Sidney G. Wenham (23), electrical engineer, who was stated to be indispensable. Temporary respite for medical examination was conceded.

At Burgess Hill (Sussex), on Monday, the manager of the electric light works successfully appealed for conditional exemption for the chief engineer and the meter reader and inspector, and both were directed to join the Volunteers.

Bridlington T.C. has decided to appeal to the Local Tribunal for Mr. F. Ffrench, of the electricity works, to be conditionally exempted from military service.

LEGAL.

Hudson *v.* County Tailoring Co., Ltd.

In the City of London Court, on June 29th, before his Honour Judge Rentoul, K.C., a claim was made by Mr. Arthur G. Hudson, electrical engineer, trading as A. G. Hudson & Co., Wells Court, Bow Lane, against the County Tailoring Co., Ltd., 1, Hoxton Square, to recover £5 for an electrical radiator supplied and fitted on their premises.

For the plaintiff it was stated that the defendants complained about the radiator, and plaintiff went and inspected it a month after it had been supplied. Then he found, after testing the radiator, that it had received a blow. The electrical circuit was all right, but the four formers were broken. The mere fact that the fireclay became hot showed that the electrical part of the radiator was not defective, as alleged. The defective working was entirely due to the damage which the radiator had received.

Plaintiff said he had been in business as an electrician for 16 years. He had purchased the radiator from the General Electric Co., Ltd., and when the defendants complained about the radiator not working properly, he took it to the company and had it tested. It worked properly, but had evidently been knocked over. Defendants had suggested that the voltage supplied by the Shoreditch Borough Council of 240 was too high for the radiator in question. If that were the case, the wires would have fused, but the fireclay would not have been affected. The difference between 240 volts and 220 volts was practically nothing when one was dealing with a radiator. He had offered to do the repairs for a sovereign, which was the cost price, but the defendants refused to pay.

Judge Rentoul, K.C.: If the current were too strong, might it not destroy the radiator?

Plaintiff: If there was excessive pressure, say, 500 volts, the elements would melt immediately, but it would not break the fireclay part of it.

In cross-examination, Plaintiff said he had been working for the defendants before. He knew the Shoreditch Borough Council voltage was 240, and that the radiator in question had a ticket on the back of it showing it was for 200 to 220 volts. That meant that 220 was the limit.

Mr. Walter Watts, of the heating department of the General Electric Co., said they were the largest manufacturers of electrical appliances in the country. He had been five years in the heating department and 15 years in the electrical trade, having served his apprenticeship as an electrical engineer. During the last two years between 5,000 and 10,000 radiators had passed through his hands of the type in question. When the plaintiff brought the radiator to their office with a complaint from the defendants, the wire coil was intact. The fireclay was broken across the back. He came to the conclusion that it had been knocked over on its back, and that that was the sole cause of the radiator not burning properly. It was certainly not due to any defect of the electrical part. With their radiators they gave a guarantee for 12 months against defective workmanship or heating elements. If the wire part burnt out in 12 months, or if there was a flaw in the elements, it would have been made good free of charge. As the radiator in question had had unfair usage, he refused to replace it free of charge. The radiator was suitable for 240 volts. If the voltage had been too great, the elements would have gone, but nothing would have happened to the fireclay. With the radiator in question all the elements were interchangeable, and they often changed them. 250 was the highest voltage permissible. With 240 volts it was not desirable to have a radiator of less than 210. One of the salesmen in the General Electric Co.'s employment, named W. H. Lake, had written the defendants stating that the radiator in question could not be used on account of the 240 voltage in Shoreditch, that it would burn out, and that the defendants would have to have a 230 to 250-volt radiator.

Judge Rentoul said if the defendants had sent the radiator back and said it was a 220-volt one, while the pressure in Shoreditch was 240, they would have been within their rights.

Herbert Potter, in the service of the defendants, denied that the radiator had been knocked over or damaged in any way.

Mr. Cohen, electrical engineer, Golders Green Road, who said he had had 20 years' experience, stated he had examined the radiator in question. He saw that the voltage was wrong, and that would cause all the damage that had taken place. The coils were being run at a much greater heat than they should have been, and that would cause the wires to be burnt out. They had gone at the top, which was the weakest point. If the radiator had been dropped, they would have broken towards the centre, as the strain was on the centre when the radiator was dropped. He found that the coils were brittle through overheating. In cross-examination, he said radiators would stand very little above the voltage for which they were marked. He did not agree that the radiator was suitable for 240 volts. The heat would be very much greater. He would not expect a radiator to go wrong on the first day if the damage was due to overheating. On the contrary, it would go on for three or four weeks. The radiator was brought to him for repair, and he recommended that one of a higher voltage should be obtained.

Judge Rentoul, K.C., held that the current was too strong for the wire. Plaintiff had practically guaranteed to put in a suitable radiator, and he did not think he had done so. Judgment for the defendants, with costs.

Monometer Manufacturing Co. *v.* Electric and Ordnance Accessories Co., Ltd.—Judgment.

Mr. Muir Mackenzie, one of the High Court Official Referees, gave judgment on Monday in this action, already reported.

The Official Referee, in giving judgment, said that the claim of the plaintiffs was for supplying furnaces and for extra work done in connection with those furnaces, and the defence was that the furnaces supplied were not in accordance with the contract, and were, consequently, valueless. As to a number of other things claimed by the plaintiffs, the defendants pleaded that they did not order them. The defendants also counterclaimed compensation for injury alleged to have been sustained by them owing to the default of the plaintiffs. There were two questions for consideration. The first was, what were the obligations of the plaintiffs? and the second, did they fulfil them?—both of which matters required careful consideration. At the end of 1914 the defendants were erecting new foundries for casting fuses for the Government, and for that purpose they were anxious to get the best furnaces. Attracted by an advertisement in which plaintiffs said they could supply furnaces in which the consumption of gas was less than that of any other furnace, and that they would melt aluminium without compressed air or other forced draught, they approached the plaintiffs, and, as a result, entered into a contract with them to supply three furnaces with a melting capacity of 1,000 lb. each, with 8 to 10 burners each, at a cost of £230 each; 12 smaller furnaces with a capacity of 140 lb. each, to be used in conjunction with the larger ones, for £52 each; two others of a like capacity with pouring spouts and valves, for £62 each, and three of 1,000 lb. capacity for melting aluminium swarf, for £248 each. The contract to supply these furnaces was entered into on January 15th, 1915. Subsequently, the defendants required certain alterations, and they made arrangements with the plaintiffs to carry them out. The defendants contended that it was part of the contractual obligations of the plaintiffs, first, that the furnaces should be capable of securing an output of from 50 to 60 tons a week; and, secondly, that the small furnaces should produce castings free from flaws and other defects, and that they should be fit for melting aluminium with copper. It was clear that, notwithstanding the written contract, the additional obligations contended for could have been made binding upon the plaintiffs by verbal understandings. The plaintiffs undoubtedly knew that the furnaces were required for turning out with rapidity castings for fuses, and that the metal to be used would contain a mixture of zinc, but he could not find that the plaintiffs entered into any obligation with respect to the furnaces beyond those expressed in the contract, and the question was whether the plaintiffs had made default in regard to those obligations. One cause of complaint was that the large furnaces did not provide sufficient output to feed the smaller furnaces, and that the iron pots were defective. As regarded the large furnaces, the complaint was that the defendants did not get the quantity of molten metal required; but plaintiffs had not entered into any legal obligation that they should do so. The main cause of the trouble in the smaller furnaces was due to the mixture of other metals with the aluminium. The plaintiffs did not undertake that their iron pots would not be subject to damage by alloys being melted in them. He therefore found and decided against the defendants on the main issue. The plaintiffs were not in default. The plaintiffs' claim included a large sum for extra work done, and the defendants admitted that they ordered part of the work claimed for. As regarded nearly all of the items claimed for, he decided in favour of the defendants, who were not liable for additional work unless it had been ordered by them. The person who had contracted to have things done for a certain sum was entitled to resist all claims outside the contract. He decided that the extra items, which in the aggregate amounted to £648, should be struck out. There would be judgment for the plaintiffs for £1,723 on the claim, and the counter-claim would be dismissed. As to the costs, he ordered that the defendants should pay four-fifths of the taxed costs. The case was one of the most difficult he had ever had to deal with, and therefore, without being asked, he would order a stay of execution for 14 days, and if either party lodged notice of appeal in the meantime, the stay would continue until the appeal was heard.

Judgment was entered accordingly.

FRASER & CHALMERS, LTD., *v.* THE WHITECROSS CO., LTD.

IN the Commercial Court of the King's Bench Division, on Monday, Mr. Justice Rowlatt heard a claim for over £4,000 brought by plaintiffs, of Erith, against defendants, of Warrington, for a No. 3 Bettington boiler with two pulverisers, one driven electrically and the other by steam turbine supplied to the defendants for use at their wire drawing works. The defendants alleged, in reply, that the plaintiffs had committed a breach of the contract, and they counterclaimed for over £8,000 for expenses, delay, &c.

Mr. Colefax, K.C., and Mr. Moritz were counsel for the plaintiffs, and the defendants were represented by Mr. Leslie Scott, K.C., and Mr. Paddon.

MR. COLEFAX dealt at length with the technicalities of this boiler, and explained that broadly the contract provided that it should be used in conjunction with a Green's economiser, and there were certain stipulations as to output and efficiency. The boiler was prepared at Erith and sent up to Warrington. The defendants were to provide the plant necessary to give the draught required for the efficient running of the boiler. There were certain difficulties and mishaps, and an alleged defective draught accounted for some of the trouble. Eventually, the plaintiffs asserted, the defendants turned them out of the works, and would not allow them to further proceed with the putting of the boiler into working order, and they claimed the price of the boiler from the defendants. The defendants asserted, in effect, that the boiler did not conform to the contract, that its work was useless, and that it failed to produce the guaranteed results.

The case was eventually adjourned till November next.

BUSINESS NOTES.

Glover's Almanac.—The flight of time is brought home to us by the receipt of Glover's Almanac for 1916-17. This is the fifteenth issue, a fact which speaks for itself; how many such publications have developed into—well, perennials, for annuals is clearly not the appropriate word—like this production? Very few, we are sure. The natural inference is that Glover's Almanac is welcomed by the electrical engineering community, which values it not only for the wit and humour of pen and pencil, but also for its pithy and informing extracts from technical publications. Long life to it! We have an eye on some items which we will reproduce—when the due date arrives; it is not fair to anticipate the source.

Book Notices.—"Memorandum by the Electrical Inspector of Factories on the Electricity Regulations." London: Wyman & Sons, Ltd. Price 4d.

The July issue of the *Chamber of Commerce Journal* contains the usual annual supplement regarding "Trade Products of the British Empire."

"Localisation of Faults in Electric Light and Power Mains." By F. C. Raphael. London: The *Electrician* Printing and Publishing Co., Ltd. Price 8s. 6d. net.

Telegraph and Telephone Journal. Vol. II. July, 1916. No. 22. London: The Editing Committee. Price 3d.

Dissolutions and Liquidations.—BRITISH EXPORTERS' ASSOCIATION, LTD.—This company is winding up voluntarily, with Mr. R. W. W. Spooner, 182, High Holborn, W.C., as liquidator.

VICTORY SMOKE CONSUMER AND FUEL ECONOMISER CO., LTD., Oldham.—This company is winding up voluntarily, with Mr. J. C. Atkins as liquidator. A meeting is called for August 4th, to hear an account of the winding up.

OMEGA ELECTRIC LAMP CO., LTD., Hammersmith.—This company is winding up voluntarily, with Mr. R. T. Cuff, 8, Bream's Buildings, Chancery Lane, W.C., as liquidator. Creditors should send particulars of their debts, &c., by July 7th.

BOILER SCALERS, LTD.—Creditors should send in the usual particulars to the solicitors to the liquidator (Saunders, Bradbury and Saunders, 37, Temple Row, Birmingham), by July 22nd. A meeting is called for July 31st, to hear an account of the winding up.

NAYLOR BATTERY CO., LTD.—This company is winding up voluntarily with Mr. H. Everett, 3-7, Southampton Street, Strand, W.C., as liquidator. A meeting of creditors is called for July 13th, at the Hotel Cecil.

DOWNES & DAVIES, electrical engineers and merchants, Stanley Street, Liverpool, and 78, King Street, Manchester.—Messrs. H. L. Downes (deceased) & P. L. Davies have dissolved partnership. The latter will continue the business under the same style and will attend to debts.

COLSTON ELECTRICAL WORKS, LTD., 9, Denmark Street, Bristol.—The first meeting of creditors herein was held at the Official Receiver's office, 26, Baldwin Street, Bristol, on June 28th, when it was decided to leave the matter in the hands of the Official Receiver, who will act as liquidator, in conjunction with a Committee of inspection.

Catalogues and Lists.—MESSRS. FALK, STADELMANN AND CO., LTD., 83-87, Farringdon Road, London, E.C.—Twelve-page illustrated and priced catalogue of "Lucifer" portable electric flash lamps and torches of British manufacture, also cases of various descriptions, of which large stocks are held, and lamps and batteries for which all demands can be met this season; a page of electro-medical apparatus is also included.

From MR. WILLIAM MCGREGOR, of Airdrie, near Glasgow, we have received a list of prices, together with a specimen packet, of steel grit for counterweight fittings.

MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, Huddersfield.—Eight-page pamphlet, part of their new catalogue, giving specification, price list, &c., of their "G" type c.c. generators for direct coupling.

THE FULLER ACCUMULATOR CO., LTD., Chadwell Heath.—Twenty-four page illustrated catalogue of Fuller accumulators. The five sections of the list are devoted to Block accumulators, "Sparta" accumulators, Plate type accumulators, hand lamps, and motor-car wire. The batteries, which are well shown and priced with tabular data and code-words, are for house lighting, motor-car starting and lighting, telegraph and telephone service, train lighting, &c. Owing to the large numbers of American cars in use in this country, the majority of which are fitted with starting batteries, a real need exists for a good British battery to replace the American cell. Import restrictions are now very rigid, and the Fuller Co. have met the position by making a very full range of sizes to meet the need of car-owners.

MESSRS. HOLT & WILLETS, Lion Works, Cradley Heath. Illustrated price leaflet of the "Handy" movable crowbar (Lash's patent).

Private Arrangements.—THOMAS ROYCROFT, 50, Seaview Road, Liscard, Cheshire, electrical engineer.—The creditors interested herein were called together on June 30th, when the statement of affairs presented showed liabilities amounting to £685, to meet which there were net assets of £629, after allowing for the claims of preferential creditors, the estate disclosing a deficiency of £55. It was reported that the debtor commenced business in Park Street, Liscard, about April, 1902, without capital. Owing to the fact that proceedings had been threatened by one or two creditors, and to an action to recover £161 being pending, a deed of assignment had been taken in favour of Mr. Parkin Stanley Booth, of Liverpool, to protect the estate. The debtor was not now prepared to submit any offer, and, after discussing the position, it was decided that the deed of assignment should be confirmed, and a Committee of inspection was elected to consider any offer made. The following are creditors:—

Baxendale Bros., Ltd.	£173	Malmberg, O. A.	£139
Drake & Gorham, Ltd.	32	Mills, J., & Sons	38
Downes & Davies	34	Wolff, Hy., & Co.	10
Falk, Stadelmann Co., Ltd. ..	66	Wakefield & Sons, Ltd.	23
General Electric Co., Ltd. ..	87		

Trade Announcements.—MESSRS. WAYGOOD-OTIS, LTD., announce that they have concluded arrangements with the liquidator of the Easton Lift Co., Ltd., for acquiring the goodwill, patents, stock, and work in progress of that company.

MESSRS. ELECTRICAL CONDUITS, LTD., have transferred their offices to Anchor Works, Birch Street, Walsall, and all communications should be addressed there—not to Birmingham.

MESSRS. J. H. HEATHMAN & CO., of Parson's Green, who are prepared to increase shipments to the markets of the world, have opened extensive showrooms for their ladders, trestles, steps, trolleys, trucks and barrows, as well as portable telescopic scaffolds, at 35, Aldersgate Street, E.C., near the General Post Office, at which those manufactures can be inspected.

MESSRS. JOHN C. FULLER & SON, LTD., the FULLER ACCUMULATOR CO., LTD., and FULLER'S WIRE AND CABLE CO., LTD., have transferred their offices and works to new and larger premises at Grove Road, Chadwell Heath, Essex, where all communications should be addressed. The works are in the London telephone area, and for the present the number will be "Ilford 173."

Bankruptcy Proceedings.—R. E. CONNOLD, Canterbury.—July 18th is the last day for receipt of proofs for dividend by Mr. G. E. Corfield, the trustee, 119, Finsbury Pavement, E.C.

LIGHTING AND POWER NOTES.

Australia.—A deputation from the South Brisbane Municipal Council has interviewed the Queensland Home Secretary, with a view to enabling the municipality to obtain an electric supply for lighting and power. The Council asked for authority to supply the power itself, or to obtain it from the City Electric Light Co., or any other company. The Mayor stated that the Council was not able to undertake a scheme for many reasons, as it could not enter into competition with the South Brisbane Gas and Light Co., even if the finances would permit it, and as, in the future, there might be a Greater Brisbane scheme, it would be unwise for the Council to undertake to install plant and machinery. The Home Secretary agreed that electric power was necessary for the running of factories, of which they needed many more, and promised to bring the matter before the Cabinet.—*Tenders.*

The Sydney City Council has notified hirers of electric motors that owing to the increased cost of motors and materials necessary for their maintenance, it has been found necessary to increase the hiring charges as from August 3rd next.

The Liverpool, N.S.W., Municipal Council has passed a resolution that, with a view to ensuring an efficient lighting service to the town and ratepayers, negotiations be entered into for an electric supply in the present lighting area.

The Melbourne City Council has decided that the price for electricity for battery vehicles be 1d. per unit when charging between 10 p.m. and 8 a.m.

Barnstaple.—Price Increase.—The T.C. has increased the price of electricity for lighting, as from July 1st, to 6d. per unit, with no discounts. This is due to coal having increased in cost during the year by £552, and to a reduction of £627 on the revenue received from public lighting.

Bingley.—The Electricity and Tramways Committee has decided that terms be offered for the supply of electricity to the Bingley Training College, the terms to include a standing charge of £300 a year, current at 3d. per unit subject to any fluctuations caused by coal prices, the supply to be for a term of years, and the offer to be subject to consent being obtained for borrowing powers to meet the cost of laying supply cables.

Belfast.—A proposal of the Tramways and E.L. Committee to spend £2,000 on the purchase of a number of chain-grate mechanical stokers has been referred back to the Committee for further consideration. Councillor Alexander asked for a sworn inquiry to be made into the circumstances attending the death of William M'Donald, a foreman, who met with a fatal accident on the 8th ult. The resolution having been seconded, a long discussion took place, and the resolution was negatived.

Bury.—Year's Working.—The report of Mr. Watson, borough electrical engineer, on the working of the Council's electricity undertaking during 1915-16, shows that 13,500,000 units were sold, including, roughly, 9¼ and 2 millions respectively for motors and bulk supply, the maximum load being 4,806 KW., and load factor, 32·1 per cent. The output increased by 26 per cent. as compared with the previous year, motor supply and bulk supply showing respective increases of 30 and 50 per cent. The revenue for the year was £41,308, the total generating costs were £25,455, and, after meeting financial charges, the net surplus was £2,003. There were 1,009 motors connected, of 8,513 H.P., 62 of 588 H.P. being hired. Commenting on the year, Mr. Watson pointed out that 13½ million units were generated at the new Chamber Hall station, and about a million at the old works, on account of plant extensions being deferred; this required a coal consumption of 2,564 tons at the old works, costing £1,972, whereas the new works could give the same output for 1,300 tons, costing £1,040. There are 7,300 KW. of three-phase plant at Chamber Hall and 1,500 KW. of D.C. plant at the old station. The department now supplies H.T. current in bulk to the Heywood generating station. Generating costs averaged ·45d. per unit (coal, ·259d.); all-in costs were ·69d., and average revenue, ·734d. per unit.

Chester. — Speaking on the electricity department's annual accounts, Mr. John Owen stated, at a meeting of the T.C., on the 27th ult., that the hydro scheme had been the salvation of the concern. The hydro scheme had generated 1,567,300 units, and the steam plant 1,900,023 units. The hydro scheme had exceeded their anticipations and estimate. The increased cost of coal had been £940, and if they had relied upon their steam plant, their coal bill would have been £2,283 more.

Continental.—Spain.—It is announced from Madrid that the Sociedad Minera y Metalurgica de Penarroya is about to establish an electricity generating station with a capacity of 20,000 H.P. in the coal mining district of Puertollano. The generators will be operated by gas engines using gas obtained from inferior qualities of coal available at low prices at the collieries in the district. The Penarroya Co. is also establishing a similar station of 12,000-H.P. capacity near its mines in the Belmez district. The current generated will be principally utilised in connection with the various railways belonging to the company, which are being electrified, notably the line from Fuento del Arco to Belmez, and a new line from Conquista to Puertollano.

Dalkeith.—Price Revision.—The Electric Supply Corporation, Ltd., London, has informed its consumers in Dalkeith that owing to increased costs the rate for lighting will be 5½d. per unit, and for domestic heating and cooking 2d. per unit. Supply for power will be charged according to the aggregate brake H.P. of motors supplied through each meter and the number of units used in any one quarter.

Eccles.—The Public Lighting and Electricity Supply Committee has decided that the surplus of £668 on the revenue account, for the year ended March 31st last, be transferred to the credit of the reserve fund.

Edmonton.—The Guardians have refused to accede to a request of the North Metropolitan Electric Power Co. for an increased charge for current supplied.

Farnham.—The Board of Trade has extended the electric lighting order for a year.

Finchley.—Year's Working. — The accounts of the U.D.C. electricity department, for the year ended March 31st last, show total working expenses amounting to £13,417, a total revenue of £24,150, and a gross profit of £10,733; after meeting all charges, the net profit for the year amounted to £301.

Gloucester.—Price Increase.—On the recommendation of the Electricity Committee, the Council has decided to increase the ordinary charges for electric current for lighting and power purposes by 20 per cent.

Haslingden.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to the borrowing of £1,450 for mains and £55 for switchgear in connection with the electricity undertaking.

Ilford.—Price Increase.—From the reading of the meters for the period ending September next the charge for current on all accounts will be increased by 12½ per cent. The Daylight Saving Bill has affected the undertaking considerably. On account of the difficulty in obtaining coal, a scheme has been drawn up for utilising the steam from the dust destructor.

Kendal.—Year's Working.—There is a deficiency of £390 on the working of the electricity undertaking for the year ended March 31st last.

Leek.—New Plant and Management.—The Lighting Committee, after consideration of Prof. Watkinson's report, decided that the gas engineer should be instructed to take control at once of the producer gas plant at the electricity station, and Mr. Bemrose, the electrical engineer, tendered his resignation, which was accepted. It was stated that owing to the improbability of its being able to obtain a loan at the present time, the Committee was not in a position to carry out the whole of Prof. Watkinson's suggestions. It was proposed that the Campbell gas engine and dynamo be sold at once; that a new gas engine and dynamo of about 200-KW. capacity be installed, at a cost of about £3,000; that the Stockport engines, which during the past six months had had to bear a very heavy strain, be thoroughly overhauled; that Mr. Ginman, the gas engineer, who had a fair knowledge of electricity work, be appointed general manager also of the electricity station, and that a chief assistant be appointed at a salary of £160 per annum.

Llandudno.—Year's Working.—There has been a loss of £1,499 on the working of the electricity undertaking for the year ended March 31st.

London.—The Brompton and Kensington Electric Supply Co. notifies a further increase in the price of electricity of 10 per cent.

Hammersmith.—The Electricity Committee recommends that an Underfeed stoker be fitted to a Stirling boiler at the electricity works, at a cost of £446, plus the cost of fixing and alteration of brickwork, which is estimated at £200.

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing of £2,500 by the Fulham B.C. for electricity purposes.

Woolwich.—The charge for steam generated from refuse for electricity purposes, for the year ended March 31st last, has been fixed at £540.

Having regard to the linking-up arrangements now completed with adjoining undertakings, and in order to meet further requirements, the Committee finds that it will be necessary to install an additional boiler at Globe Lane station. A boiler, superheater and economiser are to be obtained for £5,890. Subject to approval of the application for sanction to borrow, mains are to be extended, at a cost of £618, for the supply of electricity to certain workers' hostels; it is expected that, when the premises are fully occupied, the revenue will be substantial in amount.

Loughborough.—Year's Working.—During the year ended March 31st last the Council's electricity undertaking had a revenue of £8,291, and gross profit of £3,795, while after meeting financial charges a balance of £302 remained. The total output sold amounted to 1,303,341 units, as compared with 929,000 units in 1914-15; of the total 1,091,229 units were sold for power. The total connected load was 1,694 KW., and the maximum load 772 KW.; 186 motors of 1,100 E.H.P. are in use. The total working costs averaged ·77d. per unit, coal costing ·27d.

Luton.—Year's Working.—The total working expenses of the electricity undertaking for the year ended March 31st last amounted to £27,639, the income was £44,366, and the gross profit £16,727, being £2,954 more than last year. The gross profit equals 10·82 per cent of the capital expenditure. The net profit amounts to £6,227, being £1,797 more than last year. The following amounts have been charged against profits:—House services, £734; meters, £893; new fence, £68; alterations at depôt, £44; railway wagons, £215; additional contribution to district fund account, £200; leaving a balance of £4,072 to be appropriated. The capital repaid, or in sinking fund, was £39,933, leaving a net debt at the end of the year of £84,480; the reserve and renewals fund amounted to £6,021. The Electricity Committee recommends that the working balance (at present standing at the wholly inadequate sum of £4,416) should be supplemented by £4,010, and that meter rents be reduced as from April last.

New Plant.—The electrical engineer reports that an increased demand of over 1,500 KW. is anticipated next winter, and that it will be necessary to install two boilers with stokers and an economiser; also an additional feed pump and water-softening plant, and that provision must now be made for dealing with the ashes and clinkers from the boilers and soot from the flues and economiser. Tenders for the plant represent an expenditure of £13,574, and the engineer advises that immediate application be made to the L.G.B. for sanction to borrowing the amount. The ash and soot handling plant requires some further modification, and the engineer hopes to place definite tenders shortly. The Electricity Committee has recommended the Council to adopt the engineer's report and suggestions.

Middleton.—A local newspaper recently hinted that the report of the electricity department would show a loss of over £1,000. The journal added that the cheapness of electricity was governed by the largeness of production, and everything pointed to the wisdom of the Committee eventually adapting the Middleton works to a transforming station, and buying the current elsewhere.

New Zealand.—LAKE COLERIDGE ELECTRICITY SCHEME.—The report of the first year's working of the Lake Coleridge supply to the Christchurch City Council's electricity department shows that the revenue from sales of electricity amounted to £27,807, working expenses to £14,646, interest to £4,445, and sinking fund to £2,181, leaving a balance for depreciation and extension of £6,535. Mr. F. Black, who acted as adviser to the Council, estimated that there would be a probable loss of between £1,600 and £1,700 at the end of two years, and that the undertaking would take from four to five years to be self-supporting; the figures, however, show that not only is the department self-supporting, but that it has a substantial balance after paying all charges. Although, owing to difficulties consequent on the war, the Council has been unable to embark upon an active campaign to obtain new business, the number of consumers during the year increased from 1,623 to 2,930, and the connected load at the end of the first year's working is now 5,592 KW.

At the end of the first year of the Lake Coleridge supply, with a peak load which had been kept down with the aid of the steam plant and the storage battery to only 1,020 KW., and a connected load of 5,592 KW., the Council paid the Government only £6,200, an average of £1 2s. 1d. per KW. of connected load.—*New Zealand Shipping and Commerce.*]

Nottingham.—YEAR'S WORKING.—The working expenditure of the Corporation electricity undertaking for the year ended March 31st last amounted to £69,408. The income totalled £109,544, leaving a gross profit of £40,057. After meeting interest, sinking fund and other charges a balance remained of £11,677, of which £3,000 will go towards the rates, and the remainder will be transferred to reserve fund. The number of units sold during the period under review amounted to 13,854,461, an increase of 994,113 as compared with 1914-15; 6,406,000 units being for traction purposes, 4,125,833 for power purposes, and 3,232,595 for lighting. The last figure showed a decrease of 482,979 as compared with 12 months ago, representing a loss of revenue of £6,736. The number of 32-watt lamps or their equivalent connected at March 31st last was 526,830, an increase of 34,275 for the 12 months, being the largest increase since 1903. Two hundred and thirty-nine motors, aggregating 1,126 H.P., had been connected to the mains, making a total of 2,008 motors and 8,063 H.P., the largest increase since the supply started. The demands for current still continue, those for power purposes being specially noticeable.

Oldham.—DAMAGED CABLES.—At a meeting of the Electricity Committee, held on the 28th ult., it was reported that the Committee had approved of a suggested compromise with the Post Office Department of long-standing claims concerning damaged cables.

Salford.—The Electricity Committee has decided to revise its terms of supply to homes for Belgian refugees. An agreement is to be entered into with Zama, Ltd., for a supply of energy for a period of five years, or such further period up to 10 years as the company occupy their premises. The Committee has acceded to the application of the Peel-Conner Telephone Co., Ltd., for the supplies of energy to their premises in Upper Cleminson Street and Silk Street to be treated as one supply under certain conditions. Application is to be made to the L.G.B. for sanction to borrow (1) £2,279 to cover the cost of provision of additional plant and switchgear; and (2) £750 to cover capital expenditure in connection with the undertaking in respect of loans sanctioned by the Board prior to March 12th, 1915.

Shipley.—LINKING-UP PROPOSAL.—Preliminary steps have been taken with a view to considering the advisability of linking-up the Bradford and Shipley electricity undertakings, and the respective engineers are to report to their Committees on the subject, with a view to joint discussion later. Both undertakings now generate three-phase, 50-period current at 6,000 volts, and the Bradford authority has a duplicate H.T. main running to the city boundary, where it is within a short distance of a similar capacity H.T. main of the Shipley Council, so that the cost of interconnecting would be very small. It may be added that the Bradford Corporation and Yorkshire Power Co. have for some time been linked-up at Thornbury.

Stalybridge.—YEAR'S WORKING OF JOINT BOARD.—The working of this joint electricity undertaking for the year ended March 31st last resulted in a total revenue of £74,932; the gross profit amounted to £28,556, and, after meeting interest and sinking fund charges, the surplus was allocated as to sums of £1,120 and £3,713 to reserve and £1,536 in capital payments. During the year 28,351,600 units were generated, as compared with 22,683,680 in the previous year; 21,713,151 units were sold to private consumers, and 1,968,766 units for traction. The total production cost per unit was 375d., coal figuring at 24d.; interest, sinking fund, &c., amounted to 25d. while the revenue from the total supply averaged 661d. per unit, private supply giving 62d. per unit. It may be noted that a revenue of £50,378 was derived from private power, and £10,761 from private lighting consumers.

Stoke-on-Trent.—PROPOSED EXTENSION.—The Federated Council has referred back the recommendation of the Electricity Committee to spend £12,000 on the extension of the plant at the power house, in order that the Committee may prepare a statement showing how the proposed outlay will benefit the undertaking.

Sutton.—PRICE INCREASE.—The manager of the E.L. Co. has informed the U.D.C. that, as a temporary arrangement, the price of energy for lighting will be increased from 5½d. to 6d. per unit, and for power and heating by from ½d. to ¼d. per unit.

York.—YEAR'S WORKING, &C.—The Corporation electricity accounts for the year ended March 31st show a gross revenue of £37,860, and an expenditure of £21,300, leaving a surplus balance of £16,560, which is reduced to £1,456 by interest, sinking fund and other charges.

The Electricity and Tramways Committee has authorised the town clerk to apply to the Board of Trade for an extension of the period fixed for the laying of mains in the Bishopthorpe and Acomb districts authorised by the York Electric Lighting (Extension) Order 1914, which is about to expire.

Yeovil.—The Board of Trade has extended the prov. order for a year,

TRAMWAY and RAILWAY NOTES.

Australia.—TRAMWAY ELECTRIFICATION.—The electrification of the Newcastle tramway system was urged by a deputation representing the Mayors of Newcastle and neighbouring boroughs who waited on the Minister for Railways (Mr. Hoyle) recently. The Minister, who expressed his sympathy with the deputation, pointed out that the difficulty in the way was the lack of money. As soon as the necessary money was available the work would be proceeded with.

Continental.—ITALY.—A decree has been published approving a convention between the Italian Government and the Roma Nord Tramway and Railway Co. for the construction and working of an electric railway from Rome to Viterbo, *viâ* Civitacastellana.

Chester.—YEAR'S WORKING.—The tramway accounts for the past year show a surplus of £1,485, compared with a surplus of £903 for the previous year, the increase being mainly accounted for by the reduction in the power expenses—£1,828 (1·39d. per car-mile), compared with £2,256 (1·56d. per car-mile). Traffic revenue showed an increase of £73, and the car-mileage last year was 30,727 less than in the previous year. The reserve fund stands at £6,557, which represents 8 per cent. of the total capital expenditure.

Croydon.—A report has been submitted to the B.C. by the Tramways Committee recommending certain increases in wages and payments for overtime, at an estimated cost of £1,865 per annum; it was pointed that on the year's working up to March 31st the surplus, if any, would be small, the cost of electricity during the year had increased by £2,893, war allowances and bonuses had absorbed £5,906, and stores and materials showed a great advance in prices. In order to meet the proposed improved conditions for employés, the Committee recommended a revision of fare stages. The question was adjourned until the next meeting.

It was stated that the strike had almost collapsed, only eight more motormen being required to make up the normal number.

Darwen.—The Corporation has decided to increase the charge for electricity supplied to the tramways to 1½d. per unit (equal to £400 per year). This is imposed at a time when the tramway receipts show a fall over a period of three months of over £100. New rails are so expensive that arrangements have been made with the Blackburn authority for the loan of apparatus to cut out the bad portions, with a view to replacing them with short lengths.

Glamorgan.—The Rhondda Tramways and Electric Supply Co. appealed against the assessments of the generating station at £2,500 and the tramway undertaking at £5,500 rateable values; the appeal with regard to the generating station was dismissed with costs, and the assessment of the tramway undertaking was reduced to £4,500 net.

Halifax.—The Tramways Committee has appointed a Sub-Committee to consider the question of tramways at Hebden Bridge, and all matters connected therewith, between the District Council and the Corporation, with full power to obtain such expert advice as is necessary.

Keighley.—TRAMWAY ORDER EXTENSION.—The Corporation proposes to apply to the B. of T. for a prolongation of the period limited for the completion of the works authorised by the Keighley Corporation Tramways Order, 1903 (confirmed by the Tramways Orders Confirmation (No. 2) Act, 1903), and of the periods limited for the commencement and completion of the works authorised by the Keighley Corporation Tramways Order, 1909 (confirmed by the Tramways Orders Confirmation Act, 1909).

London.—WOOLWICH.—The B.C. has consented to the proposal of the L.C.C. to lay additional tramway tracks in High Street, Plumstead.

Manchester.—Year's Working.—During the year ended March 31st last the Corporation tramways carried 209,877,667 passengers on a car-mileage of 18,486,440 miles, or considerably less mileage than in 1915, when some 7 million less passengers were carried. Financially, the total revenue amounted to £939,470, and, after deducting working expenses, £561,439, and war service allowances, £92,808, the gross profit was £285,222, and, including added interest, £299,740. From this amount interest, sinking fund, rent and tax charges are deducted, leaving a balance of £121,181, of which £100,000 was contributed to the rates and the balance to reserve. In the previous year the rates received a similar amount, but a bigger balance, £48,584, was available for the reserve; however, war service allowances alone absorbed £60,000 more this year than last. The earnings per car-mile were the highest so far recorded, viz., 12·19d., an increase of ·897d. over 1914-15, while working expenses only increased by ·117d. per car-mile. The tramways department purchased some 28,700,000 units from the electricity department at 1·08d. per unit, and used 1·55 units per car-mile. The Corporation now operates 195 miles of single track, with 685 cars; it also operates some motor-'buses, which ran 82,711 miles and carried 758,034 passengers. The 'buses cost 8½d. per mile, including depreciation, to run, and earned 9¼d. per mile approximately.

Sir George Askwith (Chief Industrial Commissioner) has communicated with the Tramways Committee, and has forwarded a copy of a letter from the Tramway and Vehicle Workers' Association respecting the application of the society on behalf of certain grades of men for an additional war bonus. The Committee has decided to inform Sir George Askwith that it cannot see its way to grant the additional war bonus asked for, and that there appears to be no other course open than for the matter to be referred to the Committee on Production for settlement.

A Special Committee of the City Council has been appointed to take into consideration the advisability of running motor-'buses in place of tramcars in certain of the busiest thoroughfares in the city. It is stated that 3,000 cars traverse Market Street every week day.

St. Helens.—The Highways Committee has appointed a deputation to visit several towns where motor sweepers are in use, and to submit a recommendation thereon to the next meeting.

York.—Year's Working.—The tramway accounts for the year ended March 31st last show a gross revenue of £35,735 and an expenditure of £24,532, leaving a balance of £11,203. This balance is reduced by interest and sinking fund contributions to £1,792.

The B. of T. has issued a certificate of approval of the Hull Road tramways extension, and the system is now in operation with a 15 minutes' service throughout the day.

The traffic returns for May show increases from £2,896 receipts during the corresponding month to £3,180, and the number of passengers carried increased from 679,419 to 747,698.

TELEGRAPH and TELEPHONE NOTES.

Cable Tariffs.—Telegrams may now be forwarded to Ocean Island at 5s. per word, and to places on the Persian Gulf at 2s. 2d. to 2s. 10d. per word.

Telegraph Money Orders.—The Telegraph Money Order Service, which has hitherto been available, so far as the British Overseas Dominions are concerned, for Egypt, Canada, and Newfoundland only, has been extended to certain other Colonies. The telegrams of advice can be sent at the deferred rates, which will reduce the telegraph charges by one-half.

The Postal Services.—On Monday last, Mr. J. A. Pease, the Postmaster-General, presented the annual estimates of his department in the House of Commons. Referring to the telegraph service, he stated that the surcharge of 3d. on telegrams had brought in £207,000, instead of £170,000 as anticipated. The increase in the cost of telephone calls to 3d. produced only £115,000, instead of £205,000 as estimated. The total revenue from the additional charges imposed on all services in 1915 was over a million, compared with £928,000 expected; economies amounting to a million had been effected in the home service of the department during 1915-16, and the profit balance was £3,320,000, against £3,380,000 in the previous year and £6,650,000 in the year before the war. The total revenue had increased by four millions over the previous year to £33,650,000. Expenditure due to the war amounted to six millions. On the Post Office tube railway £364,000 had been spent, but owing to the demand for electrical plant, the completion of the tunnel would be delayed; building construction had also been curtailed.

Out of 90,000 postal servants of military age, 52,000 were serving with the Colours. Of 21,700 starred men under the Derby scheme, 6,000 belonged to the engineering and signalling services, and were regarded as indispensable for telegraph and telephone maintenance at home. Of the men over military age, good work had been done by 300 members of the Volunteer Training Corps. The work of the women, who had volunteered to do duty at night at telephone exchanges during Zeppelin raids, deserved very high praise. During the storm in March last 2,150 poles were broken, 6,050 were uprooted, 33,300 were blown over, and 41,500 had to be re-erected—apart from the railway telegraphs. Broken copper wire measured 17,000 miles in length and weighed 1,500 tons. Underground communication saved the situation, but was very costly; after the war it would be extended. Recently 7,000 new telephones were erected for the Army.

Referring to the Marconi contract, and statements made at the meeting of the company on Friday last, reported in our "City Notes" to-day, Mr. Pease said that a contract was sanctioned in August, 1913, but there was considerable delay prior to the outbreak of war in carrying it out. Disputes arose, and the P.M.G. gave notice to the company to cancel the contract, subject to reimbursement for expenses incurred. The company protested against the cancellation of the contract, and the P.M.G. then said that the Government was willing to proceed on the original terms, but the company declined to go on with the contract except upon compensation. Negotiations were re-opened in June, and the company and the Admiralty arrived at a provisional agreement requiring the sanction of Parliament by a given date. In the autumn, however, the First Lord dropped the negotiations, as the Admiralty's needs did not justify proceeding with the contract. The result was that a petition of right was sent to the Home Office in December. When he became Postmaster-General in January, and found this litigation threatening the Government, Mr. Pease consulted the Admiralty, War Office, Colonial Office, and India Office, and they came to the conclusion that four stations ought to be proceeded with. The Government had definitely offered the Marconi Co. the following terms:—That the 1913 contract should be varied, and that the erection of only four stations at the present time should be one of the variations; compensation for any actual loss which the company might prove they had sustained owing to the delay of the work so far as this might have been caused by any act or omission of the Postmaster-General, and owing to the variation of the 1913 contract; that compensation should be settled by impartial arbitrators with judicial experience, or, failing agreement, by a Court of Law. In the event of these terms being accepted, they would be submitted to Parliament for ratification. There seemed, however, to be no prospect of agreement being arrived at with regard to the two points to which he had referred, and some kind of reference seemed to the Government to be the right course to adopt, with a view to securing an amicable and satisfactory settlement. The Post Office was now awaiting a reply to this offer.

Wireless Record.—An operator on the American mail steamer *Ventura*, on a voyage from San Francisco to Sydney, claimed to have made a new record, receiving signals from the Tuckerton station over a distance of 9,000 miles with the aid of the Audion detector.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—July 7th. Corporation. One 5,000-kw. turbo-alternator with surface condenser and auxiliaries, for the Electricity Department. See "Official Notices" June 23rd.

Australia.—Perth.—July 19th. P.M.G. Supply of insulators (Schedule 510). See "Official Notices" June 9th.

August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

Melbourne.—July 26th. Victorian Railway Commissioners. 400 signal lighting transformers.*

August 8th. Deputy P.M.G. Standard battery material:—Porous pots, jars, zinc and carbon rods, and chemicals. Schedule 1,327. High Commissioner's Office, 72, Victoria Street, S.W.

Sydney.—August 17th. Portable internal-combustion engine and dynamo (2½-kw.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

Brisbane.—July 31st. P.M.G. Power board and accumulators. Schedule No. 381.

Barrowford.—July 8th. U.D.C. Automatic control electric screen cleaning gear for the sewage disposal works. Mr. F. Sutcliffe, Surveyor to the Council.

Manchester.—July 11th. Electricity Committee. (*a*) Electric or hydraulic coal-wagon lift and turntable; (*b*) saddle tank steam locomotive. Specification, &c., 21s. (returnable), from Mr. F. E. Hughes, Secretary, Electricity Dept., Town Hall.

Morecambe.—Corporation. 1,200 tons of rough slack. See "Official Notices" to-day.

New Zealand.—Invercargill.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

Plymouth.—July 20th. Corporation. Rotary steam boiler feed pump for the Electricity Department. See "Official Notices" June 30th.

Rochdale.—July 12th. Electricity Committee. Paper-insulated cable for 12 months. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Warrington.—July 11th. Electricity Department. 7,000 tons of slack coal for six months, or alternatively 12,000 tons during 12 months. Mr. F. V. L. Mathias, Borough Electrical Engineer.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Birmingham.—Corporation Lighting Committee. Overhead electric runway, including a travelling electric pulley-block and bogey trolley, £421: Herbert Morris, Ltd.

Bridlington.—T.C. 1,000 tons of Bullcroft Main washed small coal, for the electricity works: W. B. Wilson, York, 19s. 9d. per ton.

Buxton.—U.D.C. Pilsley hard slack coal (2,500 tons) for the electricity works: Day & Ferguson.

Glasgow.—Tramways Committee. Iron and steel bars for three months: P. & W. MacLellan, Ltd.

Halifax.—Tramways and Electricity Committee. Steel bridge, &c., over the dam at the electricity works: Joseph Webb and Sons, Ltd., £369.

Ilford.—Electricity Committee. 500 tons of Graigola large Welsh coal, at 28s. 5d. per ton: E. Foster & Co.

Kingston-on-Thames.—Town Council. Fitting the new crankshaft to the Diesel engine recently damaged, at £400, inclusive of work in connection with the fly-wheel alternator: Belliss & Morcom.

London.—FULHAM.—The Electricity Committee recommends the acceptance of the tender of Messrs. Cory Bros. for 2,000 tons of Coppice slack coal, at 20s. 10d. per ton.

HAMMERSMITH.—The Electricity Committee recommends the acceptance of the offer of the Underfeed Stoker Co. for one Class E Underfeed stoker, at £446; and that the offer of Messrs. Cory Bros. and Co., Ltd., be accepted for the supply of 3,000 tons of Gedling High Hazel peas, at 25s. per ton; 2,000 tons ditto Top Hard peas, 23s. 6d. per ton; 2,340 tons Hucknall High Hazel ¾-in. slack, 22s. 2d. per ton. These deliveries, with the coal in stock, will meet the requirements up to December next.

WOOLWICH.—B.C. Electricity Committee:—

Siemens Dynamo Works, Ltd.—Switchgear and recording meters, £133.
Babcock & Wilcox.—Additional boiler, superheater and economiser, £5,890.

Luton.—Electricity Committee:—

Clarke-Chapman & Co.—Two boilers and stokers complete, £7,648.
E. Green & Sons.—Economiser, £1,091.
W. T. Avery, Ltd.—Coal-weighing machines, £440.
Harris Anderson Patent Feed Water Filter Co.—One water softener, £455.
Hayward, Tyler & Co.—One rotary feed pump, £258.

Manchester.—Electricity Committee:—

One coal stacker, supplied with 420-volt, A.C., three-phase motor.—Fraser and Chalmers, Ltd.
Three electric capstans.—Sir W. G. Armstrong, Whitworth & Co., Ltd.
Scrap cable and copper.—B.I. & Helsby Cables, Ltd.
Cables.—Pirelli-General Cable Works, Ltd.; Western Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Callender's Cable & Construction Co., Ltd.; B.I. & Helsby Cables, Ltd.; Chas. Macintosh & Co., Ltd.

Tramways Committee. Steam coal, John Smith & Co.

Northampton.—Corporation Tramways Committee. Renewal of woodwork at cooling tower: G. W. Souster & Son, £389.

Salford.—Tramways Committee. Steel car-wheel tires and axles, at a schedule of prices amounting to £279: Hadfields, Ltd.

Electricity Committee. Work in connection with the installation of two water-tube boilers at the Frederick Road station:—

J. Gerrard & Sons, Ltd.—Foundations and structural work, £1,100.
New Conveyor Co., Ltd.—Coal conveyors, bunkers and chutes, £1,504.
J. Russell & Son, Ltd.—Mild-steel piping, £211.

Coal during 12 months:—

Clifton & Kersley Coal Co.—18,000 tons No. 2 washed slack, at 17s. 6d. per ton, £15,750.
Andrew Knowles & Sons, Ltd.—12,000 tons washed slack, at 17s. 6d. per ton, £10,500.
Earl of Ellesmere.—6,000 tons best washed slack, at 18s. 4d. per ton, £5,500; 4,000 tons ditto, at 16s. 8d. per ton, £3,335.

Tyldesley.—The Electricity Committee has accepted the following tenders:—

Lead pipe.—Glover & Co., Ltd.
W.I. tubes and fittings.—J. Spencer, Ltd.
Steel mains.—British Mannesmann Tube Co., Ltd.
Coal.—Unsworth & Cowburn; W. Reay & Co.; Abram Coal Co., Ltd.
C.I. pipes.—Sheepbridge Coal & Iron Co., Ltd.

Wolverhampton.—Corporation. Willans & Robinson, Ltd.: One 5,000-KW. Zoelly type turbine, running at 3,000 R.P.M., with Siemens generator; also a surface condensing plant (W. & R.) with Rees-Roturbo pumps for use in conjunction with it.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Saturday, July 8th. At 3 p.m. At the Tavistock Hotel, W.C. Discussion on "The Effect of the War on Electric Supply Undertakings," to be opened by Mr. P. MacAlister.

NOTES.

Correction.—In a number of copies of this issue, in the announcement of Messrs. Scholey & Co., Ltd., appearing on page 6 of our Advertisement Supplement, in the letterpress relating to the Paragon earth cone an error occurs. Where the clause "constructed of *permanent* copper" appears, it should, of course, read "*perforated* copper."

Books for British Prisoners Abroad.—British prisoners of war desirous of carrying on serious reading can obtain, free of charge, educational books on almost any subject by writing to Mr. A. T. Davies, at the Board of Education, Whitehall, London, S.W. All applications for books should be sent through, or endorsed by, the senior (or other responsible) British officer or N.C.O. in the camp. Where for any reason (which should be stated in the application) this course is impracticable, requests from individual prisoners will, as far as possible, be acceded to.

Electric Vehicle Progress.—The June issue of the *Electric Vehicle* bears witness to the continued progress of the "Electric" in Great Britain, the number of such vehicles in use, or on order, having now reached 740, as compared with 150 two years ago. It is satisfactory to note that the Midland Railway Co. now heads the list of English industrial users with 73 vehicles, in addition to seven platform trucks, as against the 70 of Messrs. Harrods, Ltd., the former record holders. Quite a respectable number of municipal sanitary departments have invested in electric dust vans, and the list of electric supply authorities who are (and, of course, all ought to be) users of the "Electric" has grown considerably.

An instructive article deals with the success of the Sheffield dust vans, and it is worth noting that Mr. Priestley, the cleansing superintendent, recommends the expansion of this method of cleansing, with the ultimate view of centralising the work at one depôt, and one destructor capable of dealing with the whole of the city's refuse.

Reference is made to the 12 months' experience of electric 'buses at York, where Mr. Hame estimates the working expenses, including tire maintenance, at 5½d. per 'bus-mile, including standing charges.

The results obtained from the Ilford 4-ton coal-tipping wagon, used in connection with the electricity works, are tabulated, the all-in-cost, averaged on 65 days' use, being 9½d. per ton carried. We note that two 5-ton electric wagons have also been ordered by the Bradford Electricity Committee to deal with 1,000 tons of coal weekly; also that the Blackpool electric street watering wagon covers 48 miles of road in an average nine-hour day, using 18,000 gallons of water, and requiring only 70 units, also *that it has displaced six horse-drawn watering vans*, which facts we commend to the notice of London Borough Councils who are "economising" in street watering because of the shortage of labour.

Electricity as a Tree Pest Cure.—Isadore Kitsee, a Philadelphia inventor, has recently patented a process for the destruction of insect and germ life harmful to plants and trees, by applying a solution such as saline water where the ground is to be treated, and then causing a current of electricity to be passed through the soil, whereupon the gas generated will rid the soil of germs, larvæ and insects without the least injury to the vegetation. When the plant itself is to be treated, it is sprayed with a solution after electrolysis.

Engineers' Wages.—The Government Committee on Production have awarded engineers employed in steel works throughout Scotland an increase of 1d. per hour, which raises the minimum rate to 10½d., or £2 6s. 9d. a week.—*Daily Telegraph.*

Enemy Holdings in British Companies.—In the House of Commons on Monday, Mr. Harcourt, replying to a question, said: "Shares and debentures held by enemies in British companies of the nominal value of £1,300,000 have at present been vested by the Board of Trade in the Public Trustee for the purpose of sale. He has completed the sale of shares of the nominal value of £102,000, and is negotiating for the sale of the remainder. These shares have been sold by private treaty and on the Stock Exchange in cases where there is a quotation. In several pending cases the shares are being put up for sale by public auction."—*Times.*

Alien Enemy Patents.—Application has been made to the Board of Trade by the Suffolk Electricity Supply Co., Ltd., for the avoidance or suspension of Patent No. 4908/09, granted to Aust, in connection with internal-combustion engines.

Inquiries.—Makers of portable telephones for rescue work in mines, with special drums and winding gear, are asked for,

Educational Notes. — CITY AND GUILDS OF LONDON INSTITUTE.—The report of the Council for the year 1915 states that the absence of many members of the staff on active service threw much extra work on those left behind, and on the heads of departments. The staff, and some of the senior students, undertook much new and original work in connection with the design and manufacture of munitions of war, during both the vacations and term time. The delay in the completion of the Goldsmiths' Company's Extension of the City and Guilds (Engineering) College, caused by the prolonged building strike before the war, necessitated the postponement of the equipment of the new laboratories. The Delegacy of the City and Guilds (Engineering) College reports that during the session 1914-15, 382 students were in attendance, exclusive of 131 students who were on the register of the College as due to return, but had joined the Forces. During the session, 102 students went on active service, making a total of 233 on military service, exclusive of past students. Thirty more had entered munition work outside the College, and 31 members of the staff had joined the Forces. The Roll of Honour totalled 811 names (to November 10th), 514 being commissioned officers and 297 N.C.O.'s and privates. Very important work was being done by Profs. Dalby and Mather in connection with war problems. Of 382 students, 202 were engaged in Civil and Mechanical Engineering, 71 in Electrical Engineering, and 56 in special courses, while 44 students of the Royal College of Science were attending the College for Applied Electricity. The average age of candidates for matriculation was 18·7 years.

Out of 59 second and third year students attending the City and Guilds Technical College, Finsbury, 40 joined the Forces. Important work in connection with the war had been carried on at the College. The number of day students attending the College in the winter of 1915 was 121, of whom 48 were in Electrical Engineering. The evening classes had been suspended.

In the Department of Technology the number of candidates for examination fell off considerably—from 23,119 to 15,623 for the United Kingdom. The total number examined was 18,327.

The total income of the Institute in 1915 was £27,666, and the expenditure £26,308. The expenditure of the Delegacy on the C. and G. (Engineering) College was £24,081, and that of the Technical College, Finsbury, was £10,311.

COMMITTEE ON NEGLECT OF SCIENCE.—A meeting of the governing body of the Imperial College of Science and Technology was held on Friday last, at which Lord Crewe, who presided, referred to two memorials which he had received from the professorial staff with regard to the teaching of science. He stated that a Royal Commission on the subject would not be appointed, but the Prime Minister's Reconstruction Committee would undertake the work of supervising the changes that must be made in the national system of education, being able to take immediate action. A Special Committee, of which he would be the chairman, would be appointed to inquire into the alleged neglect of science in our educational system, in close concert with the President of the Board of Education, and to advise the authorities how to promote the advancement of pure science and the interests of industries dependent on the application of science. The further provision of scholarships and bursaries would be considered, and the need of amending the system of examination for the Civil Service would be dealt with. The investigation would be made as wide as possible without delaying prompt action.

The report of the Board of Education for 1914-15, issued last week, stated that the Board was fully alive to the importance of the problems which pressed for solution in all branches of education, and in particular to the necessity of encouraging and developing the higher branches of study concerned with science and research.

COUNCIL FOR ORGANISING BRITISH ENGINEERING INDUSTRY.—The Committee on Engineering Education and Research, appointed by the Council, has presented its report, with which we will deal in an early issue.

MANCHESTER MUNICIPAL SCHOOL OF TECHNOLOGY.—The Sub-Committee has established a Lectureship in Fuel. Two rooms are to be adapted for use as mechanical and electrical research laboratories.

Electricity Regulations.—A second edition of the Memorandum of the Electrical Inspector of Factories on the Home Office Electricity Regulations for factories and workshops has been issued, dealing with points which have arisen since the first edition was published. A note has also been added regarding low-pressure and medium-pressure switchboards, with special reference to distribution boards and motor-starting panels; it is pointed out that these are included under the term "switchboards," a fact which is sometimes overlooked, with serious consequences. Where the pressure is not more than 125 volts A.C. or 250 volts D.C., of course the installation is partially exempt, but otherwise all the regulations are applicable, and the note explains how they can be complied with; even in the former case the requirements of Regulations 1, 5, and 14 must be met.

More Sniping in Dublin.—A military sentry who was guarding the municipal electricity station in Fleet Street, Dublin, was, according to the *Times* correspondent, shot in the leg and badly wounded, on Tuesday morning. It is supposed that the shot was fired by a sniper on one of the high houses which surround the works. The sniper escaped.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Saturday, July 8th.—Instructional Class, 2.30, Company Commander Fleming.

Monday, July 10th.—Technical for Platoon No. 9, 46, Regency Street, S.W. Squad and Platoon Drill, Platoon No. 10. Signalling Class and Recruits.

Tuesday, July 11th.—Officer Instructional Class, 6-7. Recruits, 7-8. Lecture, 7.15, "The System of Command," Company Commander W. Hynam.

Wednesday, July 12th.—Platoon Drill, No. 3 Platoon.

Thursday, July 13th.—Platoon Drill, No. 7 Platoon. Recruits, 5.45-7.45. Instructional Class, 5.45.

Friday, July 14th.—Technical for No. 10 Platoon, 46, Regency Street, S.W. Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 15th.—Parade, Golder's Green Station, 3 sharp. Uniform.

Sunday, July 16th.—Entrenching duties. Parade, Victoria (S.E. and C. Railway Booking Office), 8.35 a.m. Uniform, haversacks, and water bottles. Midday rations to be carried. Railway vouchers will be provided.

MACLEOD YEARSLEY, *Adjutant.*

3RD BATT. (OLD BOYS') CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, July 6th, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Wembley Park, at 3 p.m., for Drill under the Commandant. The Commandant desires members who did not pass the Examination last Saturday to attend for re-examination.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30, and proceed by train for Entrenching duties.

Recruits will Parade at Wembley Park on Saturday at 3 p.m., and Sunday at 11 a.m., for Recruit Drill.

G. H. F. DUNCAN, *Acting Adjutant, O.B.C.*

Electrical Worker's Claim.—At the Southampton Munitions Court, an electrical engineer, whose home is at Bournemouth, made a claim for compensation against his employers on the grounds that he was discharged at one hour's notice really to save a dispute with a trade union on account of his not being a member of the union. He also alleged that the day foreman refused to send him to work on the night shift, although the night foreman particularly wished for his services, as he liked the speed and finish of his work. The application was dismissed.

Industries of the Empire Fair.—The Board of Trade announces that the representatives in London of the self-governing Dominions and their respective Governments are not participating in this exhibition, concerning which a circular, recently issued, stated that the principal Colonial Governments would be exhibiting thereat.

Appointments Vacant.—Chief assistant electrical engineer (£350) to the Government of Tasmania Hydro-Electric Department; engineer and manager (£300) for the Borough of Loughborough electricity undertaking. For further particulars, see our advertisement pages to-day.

Australian Patents.—A Bill to suspend partially the Patents Act during the war, passed through the Australian House of Representatives on May 23rd.

Vacuum Cleaners.—IMPORTS PROHIBITED.—A notice has been issued prohibiting the importation of vacuum cleaners as from July 6th, except under special licence from the Board of Trade.

Standard Electrical Fittings for U.S. Motor Cars.—One of the features of the summer meeting of members of the American Society of Automobile Engineers, which has just taken place, was the presentation and adoption of a lengthy report by the Electrical Equipment Division of the Standards Committee. Included in the report was a complete list of sizes and dimensions for flexible steel conduit for encasing ignition and lighting wires; 15 sizes are provided for, ranging from $\frac{3}{16}$th to 1 in. inside diameter. It was reported that the Sub-Committee, which had been at work on the question of lamp standardisation generally, had conducted a number of tests of lamps and bulbs at the National Lamp Works, and had discovered certain important facts with respect to the shape of filaments and reflectors. Among the recommendations of the Lamp Sub-Committee which were adopted were:—That sockets for bulb should be so set in lamps that the pins on the bulb base are vertical; that lamps should be mounted not less than 3 ft. high, measured from the ground to the centre of the lamp, and that dimming devices are not to be recommended for the purpose of eliminating glare. A standard form of bracket for motor headlights was adopted, three sizes being provided for as meeting all requirements.

Electrical Smelting.—A company has been formed in Stavanger, with a capital of 1,000,000 kroner, for the purpose of utilising the Florli waterfall, near Lysefjordin, for electrical smelting. The necessary advances are said to have been secured from Norwegian banks, and the company will proceed with the building of factories. The waterfall, which is calculated to produce 12,000 horse-power, is said to be one of the cheapest propositions in Norway as regards constructional expenditure.—*Financier and Bullionist.*

Institution Notes.—Institution of Electrical Engineers.—The Council of the Institution, on June 8th last, appointed a Committee to consider the suggestions made in Mr. E. T. Williams's recent paper, and in the discussion on "The Present Position of Electricity Supply in the United Kingdom." After consultation with the Incorporated Municipal Electrical Association and other similar bodies connected with electricity supply, the Committee will embody its recommendations in a report to the Council. The chairman of the Committee is Mr. R. A. Chattock, and the other members are Mr. C. P. Sparks (President, I.E.E.), Mr. C. H. Merz, Mr. G. W. Partridge, Mr. S. L. Pearce, Mr. T. Roles, and Mr. W. B. Woodhouse.

A deputation of seven representatives of gas and electricity undertakings, including Mr. R. A. Chattock and Mr. C. P. Sparks, waited on the Board of Trade on June 29th, 1916, and laid before one of the officials the various difficulties which were being encountered by these industries at the moment, more especially in connection with the making of new contracts for coal for the next twelve months, both as regards quantities and prices. The deputation was received by Mr. Marwood and Mr. Carlill, who, after the various members of the deputation had stated their case, informed them that the Board of Trade were prepared, if approached by gas, electricity, or water undertakings, to use their influence through the medium of the District Coal Committees which had been established in the various colliery areas to procure the necessary quantities of coal required by them. With regard to prices, it was further stated that if any undertaking which had cause to complain of the prices proposed to be charged for new contracts would bring such cases before the Board of Trade, the Board would be prepared to take steps, if thought necessary, so that the prices charged should be justified by the provisions of the Price of Coal (Limitation) Act.

In pursuance of the resolution dealing with the membership of alien enemies, the Council is taking steps to ascertain the nationality of all members, and in the case of naturalised British subjects, their status as regards the country of which they were formerly subjects. A list of those who will cease to be members under the new clause will be published as soon as possible.

As we go to press we have received the *Journal* for June, which contains the third Roll of Honour, the third list of military honours awarded to members, and the eighth list of members on military service, as well as the following list of recommendations which are to be submitted by the President to the Board of Trade Committee on the Electrical Trades, on behalf of the Council:—

1. Some combination of British electrical firms, especially with regard to overseas trade, is desirable.

2. A Government Tribunal of the most independent character that can be devised to be appointed to control the electricity supply industry of the country, and also to prevent indiscriminate addition or extension of power stations or systems undesirable from the point of view of size, locality, or system.

3. In view of the necessity of securing the home market and that none other than British electrical apparatus be purchased in the United Kingdom, a protective tariff to be set up, notwithstanding such benefits as will in any case result from patriotism.

4. A permanent Advisory Committee to be appointed to ensure that, as far as possible, raw materials and parts as well as whole apparatus necessary to the trade of the British Empire shall be produced within the Empire.

5. (i) British-born electrical attachés to help in the Consular service, and (ii) trade commissioners (scientific and technical commissioners are suggested by Mr. Pollard Digby, *I.E.E. Journal*, vol. 53, p. 799, 1915), to be appointed.

6. British engineering standards to be adopted throughout the Empire.

7. The use of the metric system to be made compulsory after a reasonable period; and during this period all trade catalogues to make use of both the British and metric systems.

8. The Institution to be granted a Charter so as to improve the status and training of electrical engineers.

9. A Central Engineering Board, consisting of representatives nominated by all the important Institutions, to be established whom all engineers (other than mechanics) would be required to satisfy as to the sufficiency of their technical training and general education before they could be recognised as proficient, so as to ensure that every engineer shall qualify for his profession in the same manner as a doctor or solicitor.

10. Closer co-operation of manufacturers and other employers of electrical engineers with the technical colleges is desirable to ensure that students are trained to meet the future needs of the industry.

The foregoing recommendations indicate that the views of the Council as to the limitations of the functions of the Institution have been profoundly modified; while at this hour it is impossible to comment on the proposals at length, we hasten to congratulate the Council upon its declaration of policy, and upon the new spirit by which it appears to be animated.

Association of Mining Electrical Engineers.—A meeting of the Council of the Association was held in Manchester on June 24th, at which the principal business was the consideration of a report by the Central Committee, which consists of Mr. A. B. Muirhead, representing Scotland; Mr. Wm. Maurice, representing England; and Mr. Theo. Stretton, representing Wales. With some modifications the recommendations of the Central Committee were adopted, and the above gentlemen were then appointed as the Management Committee of the Association. They will report to the General Council meeting in October next regarding certain proposals to alter the Articles of Association, the classes of membership, and the subscription. The *Proceedings* for next session will be issued in twelve monthly parts as supplements to the official journal—*The Iron and Coal Trades Review*. The next annual general meeting will be held at Manchester on October 7th. A number of members were elected to serve on the Mining Committee of the Advisory Council for Scientific and Industrial Research.

American Institute of Electrical Engineers.—In the *Proceedings* for June, an interesting account is given of a National Meeting of the Institute, held after the Annual Meeting at New York on May 16th. This National Meeting was held simultaneously by means of long-distance telephony in Boston, New York, Philadelphia, Atlanta, Chicago, and San Francisco; every person in attendance at each of these cities was provided with a separate telephone receiver, and each of the gatherings took an active part in the conduct of the meeting. All the speakers, from Boston to San Francisco, were distinctly heard by everyone in attendance. Mr. J. J. Carty, the President, presided in New York over the entire meeting, which comprised over 5,000 members. Mr. C. le Maistre, the special delegate of the British Engineering Standards Committee to the A.I.E.E. Standards Committee, was present, and greeted the members on behalf of the International Electrotechnical Commission and the Engineering Standards Committee. Resolutions were moved and seconded, amended, and voted upon at this unique "meeting."

National Electric Light Association.—At the recent convention in Chicago, within the short space of three-and-a-half days, there were presented at more than 20 sessions some 2,500 printed pages of material in the form of reports, papers, and addresses. This was far in excess of any previous convention. One reason for this exceedingly large amount of material was the inclusion in the Association of the Electric Vehicle Association. In spite of the fact that there was such a great mass of material, many authors insisted on reading their entire report or paper, although each report was accompanied by a sufficiently comprehensive abstract. It is estimated that the discussion amounted to 500 pages of printed matter. The attendance was remarkably good, especially at the technical sessions.—*Electrical World.*

Chief Technical Assistants' Association.—This Association will meet to-morrow, Saturday, at 3 p.m., at the Tavistock Hotel. The chief discussion will be on the effect of the war on electricity supply undertakings. It will be opened by Mr. A. P. MacAlister, the hon. secretary.

The Mannesmann Tube Works Purchased.—It is reported that the works of the British Mannesmann Tube Co., at Swansea, are being purchased by Baldwins, Ltd., iron and steel makers, of South Wales and the Midlands, who, it is stated, have already taken over a slag brick-making establishment which was in German hands at the outbreak of war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. CHARLES A. NETHERCOT, accountant to the Bath Corporation electricity department, was successful at the recent examination (Intermediate) of the Society of Incorporated Accountants and Auditors.

The Dundalk U.C. received three applications for the post of assistant electrical engineer in room of Mr. J. E. M'Entee. Mr. B. MAYNAGH, Dundalk, was appointed.

General.—MR. WILLIAM GUY, who has been editing the *Practical Engineer* since the middle of March, terminated his engagement at the end of last month.

Battery Scout CYRIL F. BARROW, formerly assistant engineer at the Bolton Corporation electricity works, has been gazetted a second-lieutenant in the Royal Engineers (Signal Section).

Mr. ERIC STEADMAN, until recently in the electrical department of Messrs. Harland & Wolff, Ltd., Belfast, has received a commission in the Royal Flying Corps.

London Gazette notices.—Territorial Force. Royal Engineers:—

City of Edinburgh (Fortress) Engineers, Electric Lights Company.—Sapper JAMES VEITCH, from a Field Company, Canadian Engineers, to be Second-Lieutenant (on probation).

London Electrical Engineers.—Second-Lieutenant (temporary Lieutenant) H. F. G. ROOSE is restored to the establishment.

In the list of Naturalisation Certificates granted during June we find the following entry:—

AXEL ÖRLING, electrical engineer (Sweden), residing at Streatham.

Roll of Honour.—The D.S.O. has been awarded to Major E. A. LEWIS, North Midland Divisional Signal Company, Royal Engineers, who has been on active service in France since February last year. Before the war he was an electrical engineer in the Post Office engineering department, Hanley. He was mentioned in dispatches early this year.

Private H. HILLIKER, of the King's (Liverpool) Regiment, formerly employed at the British Westinghouse Works, Trafford Park, has died from wounds.

Private JAMES ALLISON, of the South Lancashire Regiment, a former employé of Messrs. Dick, Kerr & Co., has been killed in action.

Private T. CUNLIFFE, Lancashire Fusiliers, formerly with the British Westinghouse Co., Trafford Park, is in hospital suffering from shell shock.

According to the *Times*, Lieutenant SYDNEY WILLIAM BELL, Canadian Infantry, killed on June 14th, was at the City and Guilds Technical School, South Kensington. He volunteered for service in the South African War, and was with the Electrical Engineers. He took his discharge in South Africa and remained some years on the Rand as a mining engineer. When war broke out in 1914 he was employed in the Parks Department at Edmonton, Canada.

We regret to note that Captain RENE CHASSERIAND, chief editor of our contemporary *La Lumière Electrique* since 1909, has been killed by a shell before Verdun while in command of a field battery in a most exposed position. He had previously obtained the Cross for taking command of, and leading into action, an infantry company whose captain had been killed. He was originally placed in charge of a military workshop at the rear of the Army, but his patriotism induced him to prefer a more active rôle as battery commandant.

Obituary.—ALD. LONGWORTH.—Ald. Longworth, of Bolton, who passed away recently, was Chairman of the Electricity Committee, and was particularly identified with the work of carrying to completion the new generating station at Back-o'-th'-Bank. The T.C. last week passed a resolution of condolence with the relatives of the deceased, and members spoke eulogistically of his work in connection with the electricity department.

THE RT. HON. EDWARD ARCHDALE.—The daily Press announces the death of the Rt. Hon. Edward Archdale, head of the Archdale family, of Co. Fermanagh, at the age of 66 years. It is stated that the deceased gentleman "adopted civil engineering as a profession, and for some years was engaged in submarine cable laying in various parts of the world."

MR. T. C. BIRD.—The death has occurred suddenly of Mr. T. C. Bird, electrical engineer, Macroom.

The late PROF. SILVANUS P. THOMPSON.—At a general meeting of the Royal Institution, on Monday, a resolution of condolence with the relatives of the late Prof. Silvanus P. Thompson was passed.

Will.—The late Mr. F. W. LACEY, borough engineer and surveyor, Bournemouth, left £21,181.

NEW COMPANIES REGISTERED.

Elliott Bros. (London), Ltd. (144,140).—Registered June 21st, by Norton, Rose, Barrington & Co., 57½, Old Broad Street, E.C. Capital, £90,000 in £1 shares. Objects: To take over as a going concern the business carried on by W. O. Smith, W. S. Smith, G. K. B. Elphinstone, and L. W. Smith, at Century Works, Lewisham, and 1, Central Buildings, Westminster, or elsewhere, as Elliott Bros., to carry on the business of mechanical and electrical engineers, electricians, contractors, instrument makers, constructors, manufacturers and suppliers of, and dealers in, all kinds of mechanical, mathematical, electrical, and scientific apparatus, instruments, telegraphic and engineering appliances or accessories, nautical, aerial, motoring, agricultural or other implements and machinery, tool makers, founders, engravers by machine or chemical process, manufacturers of dynamos, wires, accumulators, magneto machines, lamps, motors, &c. The signatories (with one share each) are: R. O. Smith, 4, St. John's Park, Blackheath, S.E., electrical engineer; A. W. Atkyns, Sapperton, Limpsfield, Surrey, electrical engineer. Private company. The first directors (to number not less than three or more than six) are: W. O. Smith, G. K. B. Elphinstone, and L. W. Smith, with power to appoint others. Qualification, £500. Remuneration, £100 per annum, divisible. Secretary: R. O. Smith.

Filbar Electric Heater, Ltd. (144,237).—This company was registered on June 30th, with a capital of £20,000 in £1 shares, to acquire from J. Fillans Barr, of Toronto, the benefit of certain inventions and patent rights relating to electric heaters, &c. The subscribers (with one share each) are: F. Petersen, 14, St. Mary Axe, E.C., shipbroker; J. W. M. Fry, 3, Creechurch Lane, E.C., contractor. Private company. The number of directors is not to be less than two or more than five; the first are J. W. M. Fry, F. Petersen, and J. Fillans Barr. Qualification, 500 shares. Registered office: 24, Coleman Street, E.C.

Automatic Loading Co., Ltd. (144,165).—This company was registered on June 23rd with a capital of £20,000 in £1 shares, to carry on in Great Britain and elsewhere the business indicated by the title, and that of boiler makers, engineers, manufacturers of and dealers in electrical and other appliances, &c. The subscribers (with one share each) are: W. H. Beaumont, Estcourt, Hook Heath, Woking, director; J. W. Dallon, 31, Winslade Road, Brixton, S.W., manager. Private company: The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Downing, Handcock, Middleton & Lewis, Crosby Buildings, Crosby Square, E.C.

Troup, Curtis & Co., Ltd. (144,175).—This company was registered on June 23rd, with a capital of £7,000 in £1 shares, to take over the business of electrical engineers carried on by G. L. Troup and A. Curtis, as Troup, Curtis & Co., and to carry on the same and the business of electricians, instrument makers, heating, ventilating and mechanical engineers, &c. The subscribers (with one share each) are: C. L. Troup, 16, Philpot Lane, E.C., electrical engineer; A. Curtis, 16, Philpot Lane, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. L. Troup and A. Curtis (both permanent, subject to holding 2,000 shares each). Registered office: 282, Victoria Dock Road, E.

Fuller's Carbon & Electrical Co., Ltd. (144,168).—This company was registered on June 23rd, with a capital of £25,000 in £1 shares, to carry on the business of manufacturers of and dealers in carbon, charcoal, graphite, lampblack, soot, and all products which contain carbon, charcoal, or graphite, carbon filter and blowpipe blocks, carbon disinfectant seals for sewer manholes, carbon crucibles, and carbon for electrical purposes, dynamo brushes, microphones resistances, dyes, paints, inks, and polishes, mechanical and electrical engineers, &c. The subscribers (with one share each) are: G. Fuller, Elmcroft, Hutton, Essex, electrical engineer; G. J. A. Fuller, Badwell Cottage, Draycot Road, Wanstead, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are G. Fuller, G. J. A. Fuller, and L. Fuller. Remuneration, £100 each per annum (chairman £150). Secretary (*pro tem.*): F. King. Registered office: Grove Road, Chadwell Heath, Essex.

B. I. Co. (of London and Birmingham), Ltd. (144,149).—This company was registered on June 22nd, with a capital of £2,000 in £1 shares, to carry on the business of designers, manufacturers, exporters and importers of, contractors and factors for, and dealers in electric light and other electrical apparatus, conduits, dynamo machines, lamps, fittings and accessories, electric accumulators, galvanometers, ammeters, volt and other meters, motors, batteries, &c. The subscribers (with one share each) are: C. D. Falcke, 410-411, Mansion House Chambers, Queen Victoria Street, E.C., electrical engineer; J. E. Hame, 67, North Street, Plaistow, E., clerk. Private company. Cecil Douglas-Falcke is permanent managing director. Registered office: 410 & 411, Mansion House Chambers, Queen Victoria Street, E.C. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Electric Consulting & Supply Co., Ltd. (9,631).—This company was registered, in Edinburgh, on June 26th, with a capital of £1,000 in £1 shares, to carry on the business of consulting electrical engineers, &c. The subscribers (with one share each) are: R. S. Smith, 199, Bath Street, Glasgow, electrical engineer; R. M. Yellowlees, 64, Murray Road, Stirling. Private company. The first directors are J. S. A. Primrose and R. S. Smith. Solicitor and secretary: R. M. Yellowlees. Registered office: 199, Bath Street, Glasgow.

Volta Magneto Co., Ltd. (144,230).—This company was registered on June 29th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturers of and dealers in magnetos, sparking plugs, and all kinds of machinery, appliances, apparatus, accessories, and fittings for ignition purposes, or capable of being used in connection with electric light, heat, and power, manufacturers of and dealers in motor cars, motor boats, flying machines, airships, aeroplanes, &c. The subscribers (with one share each) are: H. C. Chambers, "Kerri," Blakesley Road, Yardley, Birmingham, clerk; G. J. Withington, 29, Bowyer Road, Saltley, Birmingham, clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. T. B. Sangster and H. Jelley. No qualification required. Solicitors: Pinsent & Co., 6, Bennett's Hill, Birmingham.

Stevens Petrol-Electric Vehicles, Ltd. (144,206).—This company was registered on June 27th, with a capital of £3,000 in £1 shares (1,500 "A" and 1,500 "B"), to carry into effect an agreement dated August 19th, 1915, between W. A. Stevens and Joseph Sankey & Sons, Ltd., and to carry on the business indicated by the title, and that of agents for the sale of motor and other vehicles, &c. The subscribers (with one share each) are: W. A. Stevens, "Castlemaine," London Road, Maidstone, engineer; F. O. Collis, 72, King Street, Maidstone, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are W. A. Stevens (managing director) and two others to be nominated by the holders of "A" shares. Qualification, £1. Remuneration of W. A. Stevens, £1,000 per annum. He is also to receive £150 per annum towards the upkeep of a motor car (to be purchased by himself, and to remain his property) for use in connection with the company's business. Solicitor: C. Crowther, 23, Abingdon Street, Westminster. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Robinhood Engineering Works, Ltd. (144,205).—This company was registered on June 27th, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of and dealers in sparking plugs and other ignition apparatus for use in internal-combustion engines, electrical, mechanical, and general engineers, shell and munition makers, machinists, founders, motor car agents and manufacturers, garage keepers, manufacturers of and dealers in aeroplanes, cycles, boats, and hydroplanes, &c., and to adopt an agreement with K. E. L. Guinness. The subscribers (with one share each) are: K. L. Guinness, "Aranmor," Kingston Hill, Surrey, engineer; H. P. Hawthorn, "Broad View," Stubwood, Uttoxeter, manager of engineering works. Private company. The subscribers are to appoint the first directors. Remuneration, £100 each per annum (chairman £200). Registered office: Newlands, Putney Vale, Surrey.

Wey Engineering Co., Ltd. (144,207).—This company was registered on June 27th, with a capital of £6,000 in £1 shares, to carry on the business of electrical, consulting, and mechanical engineers, electrical experts, technical advisers, manufacturers, contractors, importers, exporters, and general dealers, &c., and to adopt three agreements (1 and 3) between H. B. Ewbank and H. J. Banister, and (2) between R. P. Creagh and H. B. Ewbank. The subscribers (with one share each) are: H. J. Banister, 37 & 39, Bryanston Street, W., caterer; H. B. Ewbank, Baker Street, Weybridge, surveyor and valuer; R. P. Creagh, Baker Street, Weybridge, engineer; H. H. Beach, High Street, Weybridge, engineer; H. B. Preece, Bryan House, Church Street, Weybridge, manager; W. H. Baker, Brickwood House, Baker Street, Weybridge, accountant; C. B. Buckill, Seaton House, Weybridge, dental surgeon. Private company. The number of directors is not to be less than three or more than five; the first are H. J. Banister, R. P. Creagh, and H. B. Ewbank (all permanent). The two last-named are joint managing directors, with not less than £250 each per annum as remuneration. Qualification, £500 shares. Secretary: W. H. Baker. Registered office: Baker Street, Weybridge, Surrey.

British Electro-Chemists, Ltd. (144,181).—This company was registered on June 24th, with a capital of £10,000 in £1 shares (6,000 pref.), to adopt an agreement with China & Metal Platers, Ltd., and to carry on the business of engineers and contractors, chemists, galvanisers, electroplaters of metals and other substances, founders, machinery manufacturers, metal depositors and refiners, inlayers of metals, &c. The subscribers (with one pref. share each) are: Mrs. N. Bowen, 24, Westheath Drive, Hampstead, N.W.; W. J. Williams, 165, Graham Road, Hackney, N.E., clerk. Private company. The number of directors is not to be less than three or more than seven; the first are B. G. Clark, C. Bowen, E. D. Taylor, and B. P. Crawshaw. The first two have the right to appoint an additional director. Qualification of first directors, 100 shares; of subsequent directors, 500 shares. Remuneration, £500 each per annum. Directors' borrowing powers restricted to £20,000. Registered office: 7, Ely Place, Holborn Circus, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lobito Benguella and Catumbella Electric Light & Power Co., Ltd.—Trust deed dated June 6th, 1916, to secure £10,000 first mortgage debenture stock, charged on certain concessions and rights and company's other assets, present and future, including uncalled capital. Trustees: Rt. Hon. Lord Waleran, P.C., 24, Hans Mansions, S.W., and Bradfield, Cullompton, Devon; Rt. Hon. Lord Rotherham, 61, Queen's Gate, S.W., and Broughton, Lancs.

Brilliant Arc Lamp & Engineering Co., Ltd.—A memorandum of satisfaction to the extent of £1,800 on May 13th, 1916, of debentures dated June 18th, 1915, securing £3,000, has been filed.

Duram, Ltd.—Particulars of £20,000 debentures, created March 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £6,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Perfection Light, Co., Ltd.—Particulars of £396 debentures, created March 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Karabon Co., Ltd.—First mortgage debenture dated June 5th, 1916, to secure £150, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: D. Burke, Caxton House, Westminster.

Strode & Co., Ltd.—Particulars of £17 5s. debentures, created by resolutions of January 20th, 1913, and February 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital subject to a prior agreement. No trustees. Also issue on May 26th, 1916, of £2,500 debentures, part of a series of which particulars have already been filed.

Ilfracombe Electric Light & Power Co., Ltd. (71,378).—Capital, £15,000 in £5 shares. Return dated March 27th, 1916. 67 shares taken up; £335 paid. Mortgages and charges: Nil.

Keswick Electric Light Co., Ltd. (28,820).—Capital, £20,000 in £1 shares (15,000 pref.). Return dated April 10th, 1916. 3,420 ord. shares taken up; £3,420 paid. Mortgages and charges: £10,100.

Brompton & Kensington Electricity Supply Co., Ltd. (25,913).—Capital, £300,000 in 20,000 pref. and 40,000 ord. shares of £5 each. Return dated April 17th, 1916. 6,007 pref. and 32,993 ord. shares taken up; £5 per share called up on 6,007 pref. and 32,993 ord.; £195,000 paid; £5,000 considered as paid on 1,000 ord. Mortgages and charges: Nil.

City of Carlisle Electric Tramways Co., Ltd. (62,601).—Capital, £60,000 in £1 shares. Return dated April 14th, 1916. All shares taken up. £60,000 paid. Mortgages and charges: £58,850.

D. & M. Syndicate (Hollister's Patents), Ltd. (138,893).—Capital, £2,500 in £1 shares. Return dated June 13th, 1916. 2,300 shares taken up; £2,300 paid. Mortgages and charges: Nil.

CITY NOTES.

Edison Accumulators, Ltd.

LORD MONTAGU OF BEAULIEU presided, on June 22nd, at the annual meeting. He said that the profit for the year had been £7,398, from which must be deducted the loss on the first year's working of £1,669, leaving the profit for the two years at £5,729. This was satisfactory considering that they had been working during a period of great war stress. Their prospects were good, and they had the basis of a sound business. There was a large amount of abnormal business in consequence of the war, such as orders received in connection with munition supplies and industrial trucks for Government contract work, but normal business had been held back. As people came to realise the advantages of the electric vehicles in towns, and in districts like Lancashire and Yorkshire, where numbers of towns were situated close together and where power was cheap, they might look forward to prosperity. There had been great difficulties in getting parts of batteries and equipment through the Custom House, and Mr. Monnot, the managing director, had worked very hard to overcome these difficulties. They were now experiencing less difficulty in getting delivery of their batteries and trucks. The expansion of the business, which was three times that of the previous year, had necessitated the employment of further capital, which had been found in various ways. It was because of the immediate necessity of further working capital to meet developments that no dividends were to be distributed this year. Messrs. Harrods already had a fleet of the company's delivery vans, and were going to use more. After referring to the advantages of "electrics" in municipal service, and to the present prices of petrol, which ought to give a stimulus to electric vehicles of all kinds, Lord Montagu mentioned that in the case of commercial vehicles the "electric" needed fewer repairs than vehicles with reciprocating engines did.—Col. Sir H. C. L. HOLDEN seconded the adoption of the report, and it was carried.

Marconi's Wireless Telegraph Co., Ltd.

MR. GODFREY ISAACS, presiding at the annual meeting on June 30th, first went over the figures in the balance sheet, and then referred to the profit and loss account. The balance of the contracts, sales, and trading account had increased by £210,000. The improvement of £145,000 as compared with the previous year was highly satisfactory, particularly bearing in mind that there were substantial items not yet settled by the Government and that they had written off £53,000 in respect of depreciation of exchanges and investments. No actual loss had been incurred in exchange, as it had not been necessary to bring home from abroad the moneys which were lying at banks upon interest, nor had it been necessary to sell the investments. There was every reason to believe that before it was necessary for them to bring their money home, the exchanges would have become normal, and that they might be able to realise their securities at a substantial profit. The company's business had certainly not been normal. There was considerable work in certain parts of the world which they should have been doing but for the war, but they had received many additional orders at home and from Allied countries. The company's relations with the Admiralty had been most agreeable; that department fully appreciated how much it was indebted to the company for the admirable service rendered by it and its employés. Their associated companies had not been able to make the progress that they would have done but for the war. This applied particularly to the Spanish and Argentine companies, to the Relay Automatic Telephone Co., and to the American company. The new direct trans-Atlantic service with New York, which was ready to open when war broke out, and to which they had attached the very first importance, had continued in enforced idleness, the stations on this side having remained in the service of the Government. For this they hoped to receive due compensation. As soon as the war came to an end this new trans-Atlantic service should be productive of very considerable revenue to their American company—as well as to their own—which, added to the profits which they were now making, should place them in a position to pay substantial dividends. Independently, however, of this, they had in view in conjunction with the American company a new and very considerable programme, which it would be inexpedient for him to divulge at that moment. In regard to the carry-forward, they were satisfied that in harbouring their resources they were unquestionably acting in the best interests of the company. Had they known their position with regard to the several matters in respect of which they had to receive payments from the Government they could have made a more generous distribution, but until they knew a little more of their position in that direction it was better to act conservatively. The chairman went on to discuss the four heads under which considerable sums were stated to be payable by the Government to the company. To the end of 1915 they handled foreign messages in transmission, reception, and delivery which represented in the aggregate over 20,000,000 words. With regard to compensation, they had just completed the construction of their Carnarvon and Towyn stations, and in America, the American Co. had just erected its New Brunswick and Belmar stations, all of which represented a very considerable outlay, for the purpose of opening a direct telegraph service between Europe and America. Traffics during the period of the war had shown a very considerable increase, and there was no doubt whatsoever that the business they would have done would have been on a very large scale indeed, and the profit realised each year since the outbreak of war would have run well into five figures. They were of opinion that they should receive a substantial sum to compensate them for this loss, and they had every hope that the Government would appreciate the value which their stations and services had been to the nation and remunerate and compensate them fairly, if not generously. He had every hope that this matter would be settled in the very early future. On Monday morning last he had the assurance of the Postmaster-General that these questions were receiving his earnest consideration, and every endeavour would be made to deal with them at once. After discussing the company's claims against the Admiralty and the War Office, the speaker went on to refer to the payment to be made by the Post Office by way of compensation for their withdrawal from the Imperial Chain contract. Unfortunately, they had not yet been able to arrive at terms which they considered they would have been justified in accepting. After several inquiries without result, and many months of patient waiting, they realised that there was no alternative but to proceed with their claim for compensation, and they took the necessary steps to that end. Whether they were able hereafter to arrive at an agreement or not, there was every reason to hope that the whole matter would be dealt with and disposed of by the end of the year. But they were not in any sense depending on a settlement of this matter to carry out their promise of a substantial bonus. They looked to any one of the other three heads of their claims for that purpose. They were of opinion that they were entitled to a very large sum under each of these heads, and whichever one of them was settled first should enable them to carry out their promise. Both classes of shares would receive whatever bonus it might be decided to pay. The chairman proceeded to pay a tribute to the staff and to refer to the new invention which had matured as the result of Mr. Marconi's research work in Italy.—Capt. H. RIALL SANKEY seconded the adoption of the report.

Bastian Electric Heating Syndicate, Ltd.

The report for the year ended March last, submitted at the annual meeting, held on June 26th, showed that the net profit, including £325 brought forward, and after writing off £308 for sundry depreciations and allowances, amounts to £1,258. A dividend of 5 per cent. for the year, less income-tax at 3s. in the £, absorbs £650, and £608 is to be carried forward, subject to excess profits duty. The report is considered satisfactory under the circumstances. With a view to extending the scope of the business after the war, the directors consider that a more general name would be advisable, and the name of the company is accordingly to be changed to the Bastian Electric Co., Ltd.

British Electric Traction Co., Ltd.

The annual meeting was held on Friday last week at the Holborn Restaurant. Mr. E. GARCKE, who presided, said that in time of war the first duty of every institution, as well as every individual, was to make all possible sacrifice to defeat the enemy. At the same time, it was important that the undertakings which as taxpayers and otherwise contributed to the financial resources of the country should be preserved and continued. It was in this spirit that the directors of their associated companies had conducted their undertakings. The first thing they did on the outbreak of war was to encourage the employés of the companies to join the Forces, and they responded magnificently. The enlistment of so many of their men had caused a good deal of disturbance in their organisation, and in other respects changes had been brought about in consequence of the war which had in many ways altered the character of the business. Not only had they had fewer men to do the work, but they had had to pay higher wages. The higher wages earned by the labouring classes, however, were in a very direct way an advantage to tramway companies, for the tramways did better when the masses were earning good money than in times of commercial depression. But other effects of the war had been prejudicial to the business. There was great scarcity of material, and the material they were able to obtain cost them more. Altogether, their working expenses had increased considerably, and it had to be remembered that they were not able to charge correspondingly more for their services. Their tramway fares and the rates they charged for the supply of electricity were fixed by Acts of Parliament, and in most cases could not be increased. If, therefore, they showed larger profits it was because they had done very much more work, for they had earned less per passenger and per unit. An Act had been passed taxing heavily all profits made during the war in excess of those of a pre-war period. There was no injustice in that, speaking generally, but tramway and electricity supply companies occupied a most exceptional position. These businesses, if they were profitable, were taken over by local authorities on the expiration of specified periods, and the price paid was generally less than the capital expended. Therefore these companies were bound to make large reserves out of profits, and it was only after the undertakings had been developed for several years that they were able to do this. A tax on profits in these cases was thus also a tax on capital. They suggested to the Chancellor of the Exchequer that the Act of Parliament should give special protection to such companies, but the only concession they had been able to obtain was that these cases should receive special consideration by the referees. They must therefore hope for the best—that no injustice would be done. Proceeding to refer to the accounts, the chairman said that the revenue from investments and sundry profits amounted to £244,000, or £8,500 more than in the preceding year, and the general expenses were £27,749, or £1,500 more. The average yield obtained on all their investments for the past year represented 5.19 per cent., which was a little higher than the figure for the preceding year after making adjustments necessitated by the reduction of capital. They had a balance profit of £209,000 to deal with, or about £11,000 more than in the preceding year. After paying debenture interest of £91,259 and the dividend of 6 per cent. for the year upon the cumulative participating preference stock, requiring £42,764, they had a balance of £75,146, besides the amount of £71,398 brought forward from the preceding year. The question of what amount should be placed to reserve had received careful consideration. Now that the capital had been reduced and past depreciation had been written off, there was not the same need as before to make large additions to reserve, but it was prudent to put aside some portion of the year's profit as a provision against further depreciation, and they thought the right course was to consider the position carefully each year. Last year nothing was placed to reserve because they did not wish to alter the figures of the reserve while the scheme of reduction of capital was in progress. They thought that an addition of £20,327 to reserve, raising it to £410,000, was the right thing to do this year without, however, making any rule in regard to the amount to be placed to reserve in future years. With regard to the dividend on the new ordinary stock, when the scheme of re-arrangement of capital was formulated, he intimated that in the first year after the scheme had been carried through they would be in a position to pay on the new ordinary stock a dividend of 4 per cent., and that they might expect the dividend to gradually improve. The accounts showed that their estimates were well founded, and that they could easily pay this year a dividend on the ordinary stock of more than the 3 per cent. they suggested, but the estimate was made before the outbreak of war, and the circumstances had since completely altered. He still believed that they would not be disappointed in future, and that their estimates of progress would be realised, but it must be remembered that the Government had placed restrictions upon issues of new capital, and some of their companies would not for some time be able to raise the additional capital they might require for the development of their business; it was probable that several of them would have to keep their profits in the business instead of paying increased dividends; that, moreover, some of the companies would apply to that company for financial assistance, and as they were in the nature of departments of their business, it behoved them to support them. It was important, therefore, that they should keep in a liquid form some part of their profits, especially as the present was not a favourable moment for the realisation of their investments. For those reasons they did not recommend the payment of a larger dividend on this occasion, and they were sure that the stockholders would approve a cautious policy in regard to the payment of dividends, especially during the war period. Having dealt with the chief items in the balance sheet and referred to the important interests which the company had in the London and Suburban Traction Co., Mr. Garcke said that the loss to their organisation of the Bombay Electric Supply & Tramways Co. was to them a matter of much regret on sentimental as well as on business grounds. They initiated this important enterprise some 12 years ago. They took substantial risks and made moderate profits in connection with it, and it was an enterprise they had every reason to be proud of, but the burden of the double income-tax proved very heavy for the large number of small Indian shareholders. There were about 4,000 shareholders of the company in India holding less than six shares each, and it could be well understood that the burden of the heavy English income-tax, in addition to the Indian income-tax, induced the shareholders to move the direction and management of the company to India. It was a policy which the directors of the company could not regard otherwise than with sympathy, for all their efforts to obtain relief from this taxation had proved unavailing. In conclusion, he would repeat shortly what he said at the last annual meeting in regard to the industrial importance and value of their undertakings. Statutory public service undertakings had this advantage over other industrial concerns, that while in normal times the profits might not be so high, their capital values were not likely to suffer during great national crises to the same extent as was the case with some other industrial enterprises. They did not think that the war would materially affect their capital values. When this terrible war was concluded by the defeat of those who had wantonly disturbed the peace of the world, the need for recuperative enterprise would manifest itself, and that company would occupy a position of strength under the altered conditions to enter upon new undertakings at home and abroad. With regard to their manufacturing departments, it was a hopeful augury that the commercial community within the British Empire was now thoroughly aroused to the necessity of being prepared not only to resist a renewal of that apparently peaceful invasion to which their industrial interests were exposed before the war, but also to establish a closer union between the parts of the Empire and with their Allies for their mutual advancement instead of, as formerly, to further the aggrandisement of their enemies.

Mr. C. S. HILTON seconded the motion.

In replying to the shareholders, the CHAIRMAN said that the directors never lost sight of the point whether anything could be done to improve the net profits, but the mere raising of fares was not always profitable. Sometimes when they had increased the fares they had found that the result was prejudicial in its net effect. There was no doubt as to the fundamental truth of the statement that the services which the company was rendering to the public were inadequately remunerated, and among the many things which Parliament would have to deal with when the time arrived would be the very important one of whether public service enterprises which had done such excellent work for the poorer sections of the community should not receive more liberal and more sympathetic treatment at their hands than had been the case in the past. The Board of Trade, in view of the altered circumstances which would obtain after the war, had already appointed an Electrical Committee for the consideration of those various matters, and their managers were now preparing evidence to submit to the Committee with, he hoped, good effect.—The report was adopted.

British Thomson-Houston Co., Ltd.

The report for 1915 shows that the buildings and machinery at Rugby, Coventry, and Willesden had been maintained in first-class condition. The usual inventory of the Rugby main factory, which was impossible in 1914, was taken in 1915, and the figures show a considerable increase over the book figures and fully justify the forecast made in the last report. The profit, after deducting all expenses and charges other than interest on debentures and loans, is £262,361, plus £13,798 brought forward. Interest paid on debentures and loans amounted to £57,922, £144,878 is to be transferred to reserves and depreciations, and £73,359 is to be carried forward. [For the year 1914 the profit was £130,868. The transfer to reserves and depreciation was £73,309.] The carry-forward includes a reserve to cover the sum payable to the Government for excess profits, which cannot be accurately determined at present. Under the terms of the trust deed securing the issue of the company's debentures, the company has this year to pay to the trustees £4,452, to be applied by them in redeeming debentures at 105 per cent. by drawings. Since the closing of the books debentures of the par value of £4,240 have been redeemed, making the total par value of debentures retired to date £34,265, and leaving a net amount outstanding at June 28th, 1916, of £177,735, as against £181,975 at December, 1915. The directors have followed their usual practice in making reserves to cover risks

in connection with bad debts and other contingencies. Annual meeting: London, July 14th.

J. G. White & Co., Ltd.

Mr. W. C. Burton presided, on June 29th, at the annual meeting. He said that business and the future outlook were so affected by the war that their operating conditions were far from normal, engineering constructional works in all parts of the world being stopped. The raising of new capital for such enterprises was not only impossible from the intrinsic conditions, but had been officially prohibited; therefore any new work that they could secure was necessarily very limited. They were fortunate in having been able to meet all their expenses and to show a net profit sufficient to cover 6 per cent. on the capital, with a comfortable margin. Their expenses were reduced drastically at the beginning of the war, and they still remained much below the pre-war standard. The work of looking after the operation of various foreign utility companies which they supervised from that office had been increased by the war, and the difficulty of securing the necessary supplies for these companies was now great. The company had for some time had more of its resources invested, and consequently under present conditions tied up, than was desirable. They had, however, been able to maintain a comfortable position as to cash in hand. With their large reserve it might appear that they could pay a larger dividend, but their resources were not, in the present situation, sufficiently liquid, and therefore this would not be desirable. With a business such as they were interested in, future development depended upon there being a supply of capital available for new constructional enterprises, and this could only be expected after the restoration of normal peace conditions. In the meantime they must husband their resources, keep together, so far as possible, the essential elements of the staff, and be in a position to take prompt advantage of the first opportunities. They were also endeavouring to develop new channels in which their experience could be utilised, more particularly by increasing and broadening the scope of their commission purchasing department, and in connection with J. G. White & Co. (Inc.), of New York, securing business with those American interests who were now for the first time giving serious attention to foreign business in South America and elsewhere.

Consolidated Electrical Co., Ltd.

Mr. H. Allen presided at the annual meeting on June 27th. He first referred to the death of Mr. Taunton, who had been secretary of this company and of the original company that preceded it. The company was to be congratulated on its earning capacity during the year, and on the condition of its finances. The total income was in excess of that of the previous year. The balance at credit of profit and loss account might have justified a 3 per cent. dividend on the ordinary shares, as before, but that would have necessitated the distribution of rather more than the net earnings for the actual period. It was wiser to submit to a slightly reduced dividend, conserving the resources. They had made no attempt at a valuation of their investments, which figured in the balance sheet at cost. The only two that gave them real cause for anxiety were the shares and bonds of the Constantinople Telephone Co. The fate of the English proprietors of that undertaking must depend largely upon the fate of Turkey at the end of the war. Political influences apart, the Constantinople Co. was a most promising undertaking. Then what was almost their best investment—one made shortly before the war—had turned out to be the worst in the matter of depreciation, though it now showed some slight signs of recovery. Taking the middle price for all their securities, and assuming the Constantinople money as lost entirely, the total depreciation represented barely 10 per cent.

Bombay Electric Supply & Tramways Co., Ltd.

According to the *Financial Times*, the report for 1915 shows that the total revenue from all sources amounted to £310,770, an increase of £8,200. The expenditure amounted to £142,091, a decrease of £2,895. The net profit aggregated £168,679, an increase of £11,095. After providing for interest on debentures, placing to sinking fund account £6,732, to depreciation fund account £28,000, providing for the annual payments for redemption of second debentures of equivalent par value £8,000, and making a contribution to officers' and employés' provident fund of £2,507, there remains an available balance of £87,670, plus £8,326 brought forward. The directors recommend a dividend on the ordinary shares at the rate of 7 per cent. per annum, free from all income-tax, £50,400, leaving to be carried forward £9,602. The gross receipts from tramways amounted to £172,051, as against £169,884 for the previous year, while the working expenses were £79,664, against £85,297. The balance of receipts over expenses was £92,386, compared with £84,587. The gross revenue from electric supply for the year, including the amount represented by sale of current to the tramways, aggregates £138,020, compared with £132,669. The working expenses were £58,132, against £55,734, and the resulting balance, £79,888, compares with £76,935 for 1914.

German Electrical Companies.

The A.G. fur Elektrische Unternehmungen, of Munich, reports a net surplus of £2,290 for 1915, as compared with £1,870 in the preceding year. It is proposed to pay 5 per cent. on the preference shares, being 4 per cent. for 1914 and 1 per cent. for last year.

The financial statement of the *Treuhand Bank fur die Elektrische Industrie, of Berlin*, which is associated with the A.E.G., shows that £500,000 out of the total capital of £1,250,000 was paid up at the end of 1915 and invested in securities. The gross profits earned last year reached £4,300, as against £33,000, the final result being a loss of £600, as compared with net profits of £21,000 and a dividend of 4 per cent. in 1914.

Companies to be Struck Off the Register.—The following are to be struck off and dissolved unless cause to the contrary is shown within three months:—

Acoustic Patents.
Anglo-Swiss Asbestos Co.
Animatophone Syndicate.
British Motobloc Syndicate.
British Tungsten Lamp Co.
Bullough's Adjustable Rail Joint Support Co.
Carlton Engineering Co.
Compagnie Générale Electrique de la Campagne.
Cone-Jackson Engineering Co.
Didelon Regulators.
Electrical Advertising Co.
Electric Safety Boiler Cleaner.
Ernest Scott & Mountain.
Glamorgan Tram & Constructional Works.
J. Defries & Sons.
Kevan Electric Co.
Machine Drying & Peat Fuel Co.
Mica Manufacturing Co.
National Lighting Corporation.
Platinum Corporation.
Southgate Engineering Co.

Telegraph Construction & Maintenance Co., Ltd.—An interim dividend of 12s. per share (5 per cent.) is announced.

STOCKS AND SHARES.

Tuesday Evening.

The second half of the year has opened auspiciously in Stock Exchange markets. Savings and profits provide plenty of capital for investment, Consols have been strong, touching a price at which the return is less than 4¼ per cent. on the money, as against the 5 per cent. offered by Exchequer bonds. Plain evidence, this, of how the investor regards the outlook for money after the war. Plain hint, also, to the holder of good stock that he had better keep it. Removal of minimum prices has had the anomalous effort of fortifying other gilt-edged securities. The despair of the conscientious broker at the result of his efforts to find unimpeachable investments of long date to pay 5 per cent. on the money would be comical, were it not so sincere.

All investment stocks and shares are hard as nails, to use the expressive colloquialism of Throgmorton Street. People ask what is the use of selling anything if they don't know where to get better value for their money. The City is openly optimistic in regard to the war, but only the uninstructed would lay much stress upon the rise in Consols as an index of approaching peace. Forced sales of American securities is the main factor in the Consols advance.

Even Mexico is undergoing one of its periodical spasms of settling-down. "President" Carranza is said to have given way to the United States on all essential points. Oddly enough, this news had a very bracing effect upon American Rails and Canadian Pacifics, and hardly any at all upon the shares of the railroad and utility companies in Mexico itself.

The Committee for the Protection of Bondholders in the Mexico Tramways, Mexican Light & Power, and Pachuca Companies have convened a meeting for Friday, July 14th, to discuss the lengthy report prepared by the Hon. F. H. Phippen, K.C., and Mr. E. D. Trowbridge. The Committee have the support of 7½ million sterling of bonds, out of the total of £12,330,371. That the value of the Mexican dollar should have fallen from a florin to three-halfpence is one principal reason why the companies have had to suspend interest payments. Bondholders will do well to make every effort to attend what promises to be a highly important meeting.

Electric lighting shares hold all their substantial rises of last week. County ordinary put on another 2s. 6d., and Westminsters further hardened, to 6¼. Besides the demand for ordinary and preference shares, there is active competition for every scrap—literally—of debenture stock that comes to market.

The Marconi meeting at the end of last week served to add fuel to the fire of bullish expectations. The chairman inferred that the gallant Senator had perfected developments of the system which would mean remarkable expansion after the war. Accordingly, the price is 11/32 up at 3 7/32. At the same time American Marconis spurted sharply to 19s., and Canadians recovered to half-a-guinea.

Anglo-Argentine Tramways issues are no worse for the passing of the interim dividend on the second preference

shares. Maybe there were some who thought that this might have to come, and, after all, it is considered as a postponement of the payment. The shares are cumulative, and as soon as the Argentine Republic manages to secure a larger proportion of shipping, industry will go ahead at a rapid rate. Brazil has been less handicapped than Argentina in the matter of freights, and this the course of prices has abundantly witnessed. Brazilian Tractions are shaking off some of their recent dulness, and this week the price shows a slight improvement.

Adelaide Supply preference shares are a good spot; the price is ½ up to its par value of 5.

In the Telegraph market, there is another goodly string of rises. The Eastern group is firm, with Eastern ordinary, Western Telegraphs and Eastern Extensions all up to the equivalent of 150 for stock. Globe ordinary and preference are both 5s. better, helped by the increase in dividend on the former. Great Northerns are 10s. to the good. Investors are trying to buy Telephones, too; United River Plates and Chiles are 2s. 6d. up.

The manufacturing group is very firm. Edison & Swan fully-paid shares are coming into prominence again, and at 35s. are 5s. higher on the week. British Westinghouse preference put on a further sixpence. Babcock & Wilcox touched 3⅛, but lost the fraction, the high price tempting out a few shares. Industrials of all kinds display considerable activity; only in the rubber department is there any noticeable dulness. There, the steady dwindling in the price of the raw material has discouraged buyers, particularly as the shrinkage is accompanied by vague statements that no real improvement can be expected until the late autumn. Copper shares also keep dull and heavy, there being little present indication of substantial recovery in the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price July 4, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 18 2
Charing Cross Ordinary	5	5	8½	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	5	4	8	—	6 18 4
City of London	9	8	12½	—	6 12 0
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 3
County of London	7	7	10⅝	+ ⅛	6 11 9
do. 6 per cent. Pref.	6	6	10⅝	—	5 15 8
Kensington Ordinary	9	7	5½	—	6 16 7
London Electric	4	3	1 7/16	—	7 11 0
do. do. 6 per cent. Pref.	6	6	4½	—	6 13 4
Metropolitan	3½	3	2⅝	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	3 xd	—	7 10 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	2⅞	—	8 13 10
South Metropolitan Pref.	7	7	1½	—	6 4 —
Westminster Ordinary	9	7	6½	+ ⅛	5 14 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	105	− 1	5 14 2
do. Def.	30/-	33/6	23	—	7 10 9
Chile Telephone	8	8	6⅜	+ ⅛	6 8 1
Cuba Sub. Ord.	5	5	9⅛	—	6 18 4
Eastern Extension	7	8	15	+ ¼	*5 6 8
Eastern Tel. Ord.	7	8	150	+1	*5 6 8
Globe Tel. and T. Ord.	6	7	13	+ ½	*5 7 8
do. Pref.	6	6	11	+ ½	5 9 1
Great Northern Tel.	22	22	37½	+ ½	5 18 0
Indo-European	13	13	49	—	6 13 8
Marconi	10	11	9 7/32	+ 11/32	3 2 0
New York Tel. 4½	4½	4½	102½	—	4 7 10
Oriental Telephone Ord.	10	10	2	—	5 0 0
United R. Plate Tel.	8	8	6⅜	+ ⅛	*6 0 9
West India and Pan.	1	N	20/-	—	9 6 1
Western Telegraph	7	8	15 xd	—	*5 6 8
Home Rails.					
Central London, Ord. Assented	4	4	73	+1	5 9 7
Metropolitan	1½	1	27½	+ ½	3 12 9
do. District	Nil	Nil	19½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1 13/16	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	6	87½	—	*6 17 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	+ ⅛	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	3 1/16 xd	+ ⅛	7 9 2
do. 2nd Pref.	5½	5½	3½	—	8 9 2
do. 5 Deb.	5	5	77½	—	6 9 0
Brazil Tractions	4	4	62	+ ½	6 19 0
Bombay Electric Pref.	6	6	16⅜	—	5 15 8
British Columbia Elec. Rly. Ptce.	5	5	60	—	8 6 8
do. do. Preferred	—	Nil	40	—	Nil
do. do. Deferred	—	Nil	39	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	40	—	Nil
do. 6 per cent. Bonds	—	Nil	34	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	32	—	Nil
do. 1st Bonds	Nil	Nil	41	—	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3	—	5 0 0
British Aluminium Ord.	5	7	26/-	—	5 7 8
British Insulated Ord.	15	17½	10½	—	7 2 10
British Westinghouse Pref.	7½	7½	48/6	+6d.	6 4 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	3⅝	—	5 6 8
Edison & Swan, £8 paid	Nil	—	10/3	—	Nil
do. do. fully paid	Nil	—	1½	+ ¼	Nil
do. do. 5 per cent. Deb.	5	5	57	—	8 15 8
Electric Construction	6	7½	15/8	—	9 16 8
Gen. Elec. Pref.	6	6	9⅞	—	6 3 1
Henley	20	25	15	—	8 6 8
do. ½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12½	—	*8 8 4
Telegraph Con.	20	20	30	—	*6 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£54	..
a Bisulphide of Carbon	"	£28	..
a Borax	"	£30	..
a Copper Sulphate	"	£51	£2 dec.
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	95/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	"	£14	..
a " Lump	"	£10	..
a Soda, Chlorate	per lb.	1/4½	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/4 to 1/4½	¼d. dec.
c " Tubes (solid drawn)	"	1/9½ to 1/11	½d.—1d. dec.
c " Wire, basis	"	1/4½ to 1/4½	¼d. dec.
c Copper Tubes (solid drawn)	"	1/6½ to 1/7	¼d. dec.
g " Bars (best selected)	per ton	£152	£8 dec.
g " Sheet	"	£152	£3 dec.
g " Rod	"	£152	£8 dec.
d " (Electrolytic) Bars	"	£131	£6 dec.
d " " Sheets	"	£151	£4 dec.
d " " Rods	"	£140	£6 dec.
d " " H.C. Wire	per lb.	1/4¾	¼d. dec.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/8½	3½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£36	..
g Lead, English Pig	"	£22 10	£2 10 dec.
g Mercury	per bot.	£16 12 6 to £16 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	"	£177	£1—£2 dec.
n " Wire, Nos. 1 to 16	per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Cuban Telephone Co.—The report shows that a gross increase in rentals and service for 1915 amounting to $154,203 was handled, with an increase in operating expenses of only $4,013, the net gain in operating income, therefore, being $150,190 for the year. This gain was partially offset by heavier expenditures for interest, and as a result the net surplus shows an increase of $105,426 as compared with 1914, or about 43 per cent. The depreciation for the year 1915 on depreciable property based on 4 per cent. of the cost was $178,478, less replacements chargeable to reserve of $76,814, leaving a net increase in the account for the year of $101,659, and a total reserve for depreciation at December 31st, 1915, of $677,467. Nearly $450,000 of the company's accumulated net cash surplus has been used this year for the purpose of carrying on the construction work required to be done under its concession and to provide for the constantly increasing additions to both the local and long-distance systems.—*Financial Times.*

Dublin United (Electric) Tramways Co.—The directors have declared interim dividends for the half-year ended June 30th of 6 per cent. per annum, less income-tax, on the preference, and 4 per cent. on the ordinary shares. The reduction of 1 per cent. on the ordinary shares is due to the loss of over £13,000 in receipts during the period of the recent rebellion, when the entire service was at a standstill.

St. James' & Pall Mall Electric Light Co., Ltd.—Interim dividends at the rate of 7 per cent. per annum on the preference and 5 per cent. per annum on the ordinary shares are announced for the past half-year.

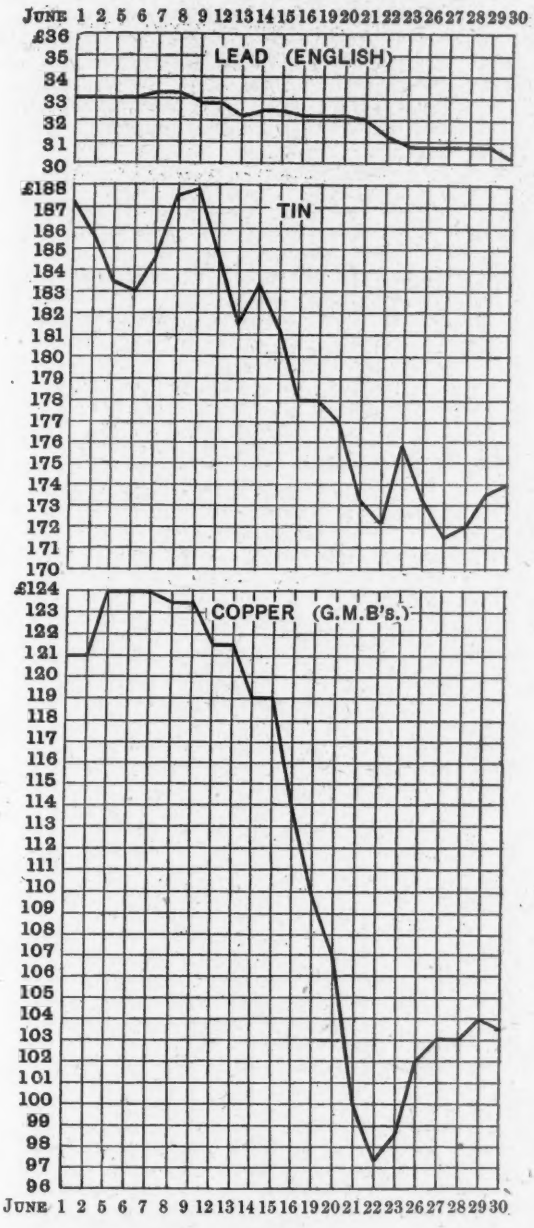
India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Interim dividend, 5s. per share, free of tax, on the ordinary shares.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter to March 31st, 3s. per share, free of income-tax.

O. C. Hawkes, Ltd.—After paying 5 per cent. on the preference shares, £4,193 is to be carried forward.

METAL MARKET.

Fluctuations in June.



Advertising Electrical Apparatus.—Referring to the letter of "A. J. G.," entitled "O ye of little faith," in our issue of June 23rd, Mr. Harry S. Ellis, borough electrical engineer, South Shields, has sent us a set of leaflets illustrating the advantages of domestic electrical appliances on the lines advocated by "A. J. G." Each leaflet carries on the front page an interesting picture of the particular feature concerned, such as electric cooking at the breakfast table, electric heating, electric cooling (with a fan), vacuum cleaning, ironing, &c., a few brief phrases pointing out the benefits derived from their use, including data regarding costs to buy and run, and on a tear-off leaf an account form bearing the statement of the amounts due from the consumer to whom the leaflet is addressed. On the back of the latter is an explanation of the tariffs in force and the discounts allowed for prompt payment. This excellent series shows fertility of resource and an eye for persuasive effect which should prove highly captivating; and Mr. Ellis assures us that this method of advertising has been found both cheap and effective.

Decimal Coinage and the Metric System.—At yesterday's meeting of the Court of Common Council of the City of London, a resolution was to be moved in favour of the nation immediately adopting the decimal system of money, weights, and measures.

ELECTRICITY ON THE FARM.

The advantages of electricity in agriculture to the farmer, to the central-station engineer, and to the nation as a whole have been fully discussed in the Review during the past two years.

We have obtained some particulars of an electrical installation on a farm on the outskirts of a northern town, where the electric supply has been used since 1904. The supply is given at 500 volts for power, and 250 volts for lighting, from the central station situated about a mile and a half away, and the service cables consist of two ·022 sq. in. and one ·012 sq. in. cables, insulated with bitumen and laid solid underground in bitumen. The original installation consisted of one 10-h.p. Royce motor and 45 lighting points, but was later increased by the addition of a 2-h.p. motor in the milk-house.

The lighting installation was carried out partly in screwed tubing, but wood casing was used in the farmhouse and in some of the outbuildings. The stables and byres were at first wired in screwed enamelled steel tubing, but on account of moisture gathering in the tubes and causing deterioration of the rubber, the enamelled tubing was subsequently replaced by galvanised tubing in these buildings. In the haylofts, sheds, barns, &c., where the enamelled tubing protection was fitted, no trouble has been experienced through insulation breakdowns.

The charge for lighting was 4½d. per unit in 1904, but the rate was reduced to 4d., then 3½d., and now it is 3d. per unit. The annual bills for electric lighting were as follows:—

Year.	Units.	Rate.	Total bill for lighting.
1904-05	266	4½d.	£4 19 9
1905-06	318	4d.	5 6 0
1906-07	324	4d.	5 8 0
1907-08	324	4d.	5 8 0
1908-09	323	4d.	5 7 8
1909-10	394	4d.	6 11 4
1910-11	381	4d.	6 7 0
1911-12	408	3½d.	5 19 0
1912-13	479	3d.	5 19 9
1913-14	417	3d.	5 4 3

The average cost of lighting for the 10 years was £5 13s. 1d., the units per annum averaging 363. During the year 1914-15 the farm buildings were occupied by the military, and the lighting bill thereby greatly increased.

The 10-h.p. motor, which displaced a gas engine, drives a line of shafting extending through the wall of the motor house to the mill house. In the latter is installed a thrashing machine, a bean bruiser, and a turnip pulper. Above, in the loft, is a cake bruiser and a straw cutter. In addition to these machines, the motor also drives a bone crusher for hen-fodder, and a turning lathe and boring machine in a small workshop adjoining the mill.

The first four years' power bills are shown below, the charge being made on a sliding scale commencing at 2½d. per unit down to 1½d. per unit.

Year.	Units.	Average Price.	Account.
1904-05	856	2·4d.	£8 13 10
1905-06	885	2·1d.	7 18 0
1906-07	1,672	2·0d.	14 5 0
1907-08	383	2·3d.	3 12 0

During the greater part of this period the farmer made full use of the motor, but in 1908 the farm changed hands, and the new tenant placed his orders for bean-meal and hay with a local grain merchant. He continued, however, to make use of the cake bruiser, straw cutter, turnip pulper, and bone-crushing machine in his farm, but the 10-h.p. motor was, in consequence, less frequently in operation, and the accounts for energy used by this motor fell off very greatly.

The price of fodder has increased enormously on account of the war, and the present tenant of the farm intends to make use again of the thrashing machine and bean-crusher, as his predecessor did before him.

In 1911 a 2-h.p. motor was installed for churning, and also to drive a small milk separator for double creaming.

The cost of electricity for these purposes, at the same rate, has been as follows :—

Year.	Units.	Cost.
1911-12	142	£1 12 6
1912-13	154	1 13 9
1913-14	110	1 2 11
1914-15	88	0 18 4

The farmer expresses himself as well pleased with the assistance he obtains from the electricity supply, and does not know how he could manage otherwise, without having to engage several additional farm-hands. The milk separator and churn are especially handy, and he contemplates adding an electrically-driven refrigerator to his plant. He is also considering other uses for the electric supply, such as a milking machine for the 50 odd cows on the farm, an electric incubator, an electric horse clipper, and a motor-driven washing machine. As the water supply is furnished by gravity from a spring on the hillside, he has no use for pumps, but he wishes to install electric heaters in the byre and milk-house to keep the temperature above freezing point in the winter. Good lighting in the byres and milk-house in the winter mornings has enabled the farmer to carry out the milking expeditiously and satisfactorily, and he emphasises the safety of electricity for lighting in hay-lofts, sheds, &c., where inflammable material is kept.

From the station engineer's point of view, the load obtained is a good one, since the farmer uses his machinery during the early part of the day, and the maximum demand, both for lighting and power, takes place in the early morning.

ELECTRICITY SUPPLY IN GREENOCK: TWO YEARS' GROWTH.

On May 2nd, 1916, an inaugural ceremony took place at the Greenock electricity works, the occasion being the addition to the plant of a fifth steam turbine and generator. This makes the second machine of 5,000 KW. capacity installed at the Dellingburn Works.

Councillor McCallum, Convener of the Electricity Committee, on that occasion gave some remarkable figures in connection with the growth of the undertaking during the last few years.

In 1913-14 it was thought that the output to Greenock consumers had reached its maximum, and that any increase in the supply was to be looked for in Port Glasgow. The units sold for that year amounted to 11,451,438, and the first few months of the succeeding year showed a reduction in the output, but, as the winter approached, the demand began to rise, partly due to the introduction of the supply to the Port Glasgow shipbuilders ; the main part, however, of the new business was due to the additional requirements of Greenock firms.

The units sold during 1914-15 totalled 14,207,575, an increase of 24 per cent. over the preceding year, of which 14 per cent. represented the additional output in Greenock alone.

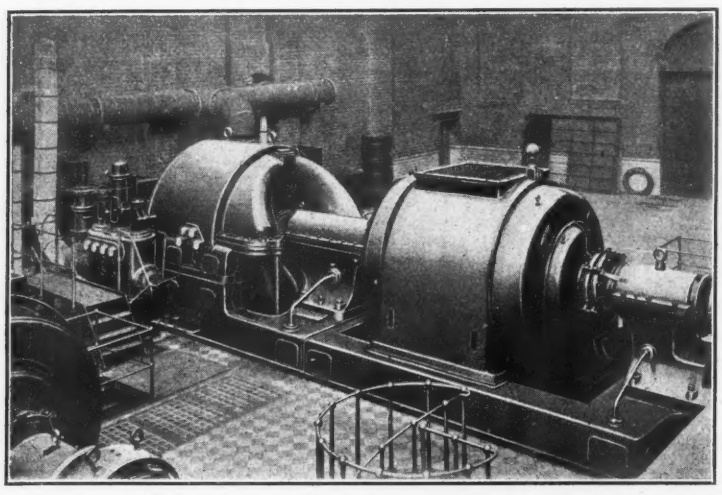
With the advent of the financial year 1915-16, new applications came in from all classes of consumers. The management immediately took steps to cope with the larger demand ; the boiler capacity was increased by the installation of new economisers, and all that was possible was done to get the maximum duty out of the existing boiler equipment. During this period full steaming power had to be obtained with all the boilers in commission, and with no reserve, so that a breakdown in any one boiler would have necessitated the curtailment of supplies.

The most serious difficulty experienced, however, during the past winter was the shortage of water for condensing purposes, owing to the drought. Extensions to pumping plant had to be rapidly laid down, and the cooling towers—which had been originally installed for the night load, when no water flows down the Cut—had to be brought into commission during the daytime.

The new scheme of extensions, for which the Corporation is at present seeking powers to borrow £45,000, includes two new boilers and a large cooling tower, as well as feeders and converting plant at the various substations. As indicating the necessity for these further additions to the plant, it may be stated that since the end of the last financial year applications have already been received for electricity supplies amounting to 1,310 KW. in Greenock and 663 KW. from Port Glasgow users, and when negotiations with several other prospective consumers are completed, a further demand of 905 KW. may be expected. The units generated for the nine months ended on March 31st last numbered 17,152,641, and the amount of energy produced for the complete year will probably exceed 20 million units generated, or nearly 100 per cent. more than the output two years ago.

The daily demand during the month of May has exceeded last year's daily demand for the corresponding period by over 1,000 KW. This represents 25 per cent. increase on last year's maximum demand, and is a very marked indication of what may be expected when the shorter days arrive, and the lighting load overlaps the power load.

The prospects for the undertaking during the next few years appear to be excellent. Shipbuilding and engineering firms expect to have plenty of work in hand for some time to come, and the sugar refineries have lately been extending their electrical machinery. In other trades, too, electric motors are being installed, despite the prevailing high prices of machinery.



Westinghouse 5,000-kw. Turbo-Alternator recently installed at Greenock.

The turbine set which has recently been placed in service is a duplicate of plant supplied to the Greenock Corporation by the British Westinghouse Co., about two years ago. The turbine is of the Westinghouse-Rateau high-pressure impulse type, rated at 5,000 KW., and running at a speed of 1,500 R.P.M. The alternator is of the patent compensated type generating three-phase current at 50 periods, 3,300 volts, and takes an overload of 25 per cent. for one hour. This set is provided with a direct-coupled exciter. Regulation is carried out by means of a rheostat in the exciter shunt field, no main field rheostat being necessary. A wet-air filter has been supplied with the alternator.

Surface condensing plant has also been installed, but no circulating pump has been supplied, as the cooling water is fed by gravity. The Leblanc air and extraction pumps are driven by means of an auxiliary turbine, which exhausts into the feed-water heater.

The accompanying illustrations show the new set, and the interior of the engine room. Our congratulations are due to Mr. F. H. Whysall, the burgh electrical engineer and manager, on the remarkable development of the undertaking under his control.

S.P.T.: A FINSBURY REMINISCENCE.

The recent lamented death of Prof. Silvanus P. Thompson must have caused old students of Finsbury to recall their college days, and to regret that the visits which so many of them pay to the place for the sake of old times no longer carry the possibility of a meeting with the genial Doctor, whose friendly interest in the careers of his old pupils was always most lively and encouraging.

"S.P.T.," as we called him, seemed more like a permanent institution than an ordinary being, and it is hard to realise that we have seen him for the last time on earth.

He possessed great learning, and that in many directions. He kept abreast, with marvellous activity, of modern developments, whether scientific, industrial, or literary. He had a keen insight into practical problems, and was always ready to give helpful advice and criticism. He was liberal-minded; a conspicuous instance of this was his attitude on the question of the laying-down of electric tramways in London, when his views, expressed more than once in speeches before the Institution of Electrical Engineers, were in marked contrast to the reactionary and stick-in-the-mud ideas of others in similar positions. He was eminent as a lecturer, with a style which could not fail to interest and attract, and he had a marvellous power of clear exposition, in which he had no superiors, and very few equals, among men of science.

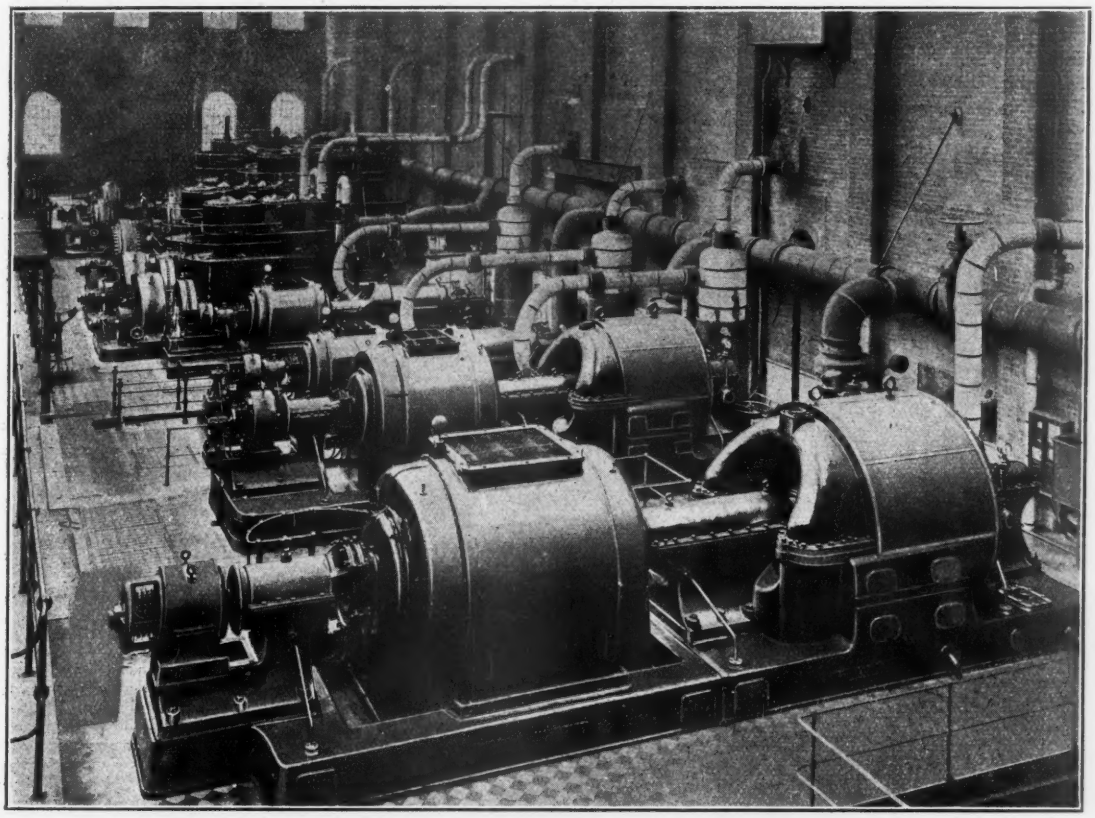
His address at the opening of each session of the college was characteristic. New students, many of them fresh from school, were encouraged to pursue their new activities, and to keep at work, in spite of the novelty of being addressed as "Mr." by the exalted beings who now replaced their former schoolmasters, and of the removal of many restrictions. Those in the middle of their course, some of whom had spent a part of their vacation in some kind of employment, were brought back to the proper frame of mind by another glimpse of the Promised Land. Those who had gone out and found the milk and honey less plentiful than they had hoped for, or who were still struggling through the wilderness, sometimes came in, and were reheartened and filled with a new enthusiasm.

These reminiscences are mostly of about 18 to 20 years ago. In those days the Doctor used to lecture on Friday afternoons on abstruse matters connected with high electrical theory. The consideration of potential was described by a somewhat mystified student as "a Johnny rushing up from infinity and plugging a brick down, and rushing off for another one."

Any misdemeanour or inattentiveness in lecture was at once checked by a silent glare. I once brought this on myself by sighing loudly, whether with despair at my own obtuseness or for some other reason is not now certain, in the middle of one of the Friday afternoon lectures aforesaid, when sitting in the front row.

One student, whose disability in the world electric was so conspicuous that his first session was also his last, was inclined to favour the back of the theatre, so that his tendency to talk, sketch, or slumber would be less noticeable. When the Doctor called the roll, and noted from whence the answer came, he said: "No, Mr. H., come nearer. You must not hide your light under a bushel."

A demonstrator of the time, who, as I have since learned to realise, was very clever, not only at his work, but at many side-lines—natural history, for example—was an extremely nervous man, and he used to jig a little piece of chalk up and down in his hand while lecturing. His lectures used to be delivered to a running accompaniment of kicks on the desks, banging of notebooks, stamps on the floor, and other uncouth and ill-mannered noises. One day the lecturer rebelled against this tyranny, announcing that he meant to carry through his lecture to its conclusion



Greencock Electricity Works: Interior of Engine Room.

on the lines he had laid down, and that if gentlemen (yes, we were called "gentlemen") would persist in interrupting, he should keep them beyond the beginning of the luncheon hour. The noise continuing, he did so, and the striking of the hour was the signal for yells of execration.

Suddenly the door behind the lecture bench opened. The Doctor! The yells were stifled in the throats of the rioters. The Doctor entered, and sat down on a chair behind the bench. He spoke no word. The proverbial pin might have fallen with an ear-splitting crash. The lecturer, who seemed nearly as alarmed as the students, and was, consequently, more nervous than ever, went on to the end, still jigging the bit of chalk up and down in his hand, and, so far as we knew, the incident closed.

At that time, and for some years after, the Physics Laboratory and the Drawing Office used to be at No. 5, a little way up the street towards the City Road. Sundry industrious experimenters discovered that a pleasing effect could be obtained by blowing down a tube attached to the gas-pipe, when Bunsen burners in the vicinity showed a livid and ghastly glare. I tried it myself, so I know. A certain student, now of some eminence as a designer of electrical machinery, but then quite the smallest person at the college, pursued this research rather too far, and extinguished all the burners in the laboratory, whereby he was discovered, and was duly reported to the Principal.

The next time all the "first-years" were gathered together in the Physics Lecture Theatre, the Doctor addressed them in grave and measured terms, pointing out the great iniquity of this practice and the danger of it, and the waste of time arising therefrom. Finally he ordered the culprit to leave the theatre; which done, he observed scathingly: "Are there any more little boys in knickerbockers?"

He was clever in the use of stratagems to fix points in the mind. On one occasion the subject was lenses and their curvature. How should we describe the curvature of a lens? This theme ran through the lecture from the beginning to the end of the hour's talk. In what unit should it be defined? And so he worked it up, till we were all quite excited and anxious to hear the answer to the question: "What is the unit of curvature?" At last, he said: "It is called one Dioptrie," and, writing the word on the board, he beamed upon the class – and said no more. I have not forgotten the dioptrie, though I have never since had any occasion to use it.

One could go on for a long time with memories of those days, now so far away, but it is time to draw to a close.

In a properly-constituted State such men as he would be knighted. Of course, I never heard him speak of the honour for himself, though he was of opinion that Dr. Ferranti and Mr. Siemens, Presidents respectively of the Electricals and the Civils, ought to have been knighted in the Coronation year.

One's cordial sympathy goes out to his staff, many of whom have proved their devotion by long service. How desolate the College must seem to them now, how forlorn the empty chair!

Let us hope a worthy successor will be found, one who understands Finsbury traditions, and who is in sympathy with the Doctor's ideals. Prof. Miles Walker, his old assistant, is one such man, and his choice would be welcomed by Finsbury men, present and past.—C.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

E.A.C. Multiple Contact Starter.

We recently inspected a large multiple contact starter for a D.C. motor driving a rolling mill, made by The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W. It is of the contactor type, with full electrical interlocking. The starting hand-wheel is shown on the upper right-hand side of fig. 1, with the regulating handle below; a push-button contact operated by the hand-wheel closes the control circuit when moved forward, but opens it at once when the wheel is moved backward, thus throwing out the initial contactors. The shunt field switch is seen at the lower left-hand corner of the figure, and is mechanically interlocked with the main switch shown alongside of it, which cannot be put down into the running position unless the field switch is first closed, as shown; the lower contacts of the field switch place a resistance across the field terminals before the circuit is opened.

The regulating switch is also interlocked by the electromagnet seen on the lower right-hand panel; the motor cannot be started unless the armature of the magnet is pushed down by a projection attached to the regulating lever, which must be put back to the "all-out" position for this purpose, and cannot be moved forward to insert resistance in the field circuit until the starting operation is completed.

The main knife switch being closed, the next operation is to close the circuit-breaker on the left-hand upper panel, which is provided with an over-load release; on turning the hand-wheel, the contactors are pulled in successively, cutting out resistance from the armature circuit, until finally the double contactor on the right closes and short-circuits all the resistance. Each contactor is provided with two auxiliary contacts, one of which interlocks the

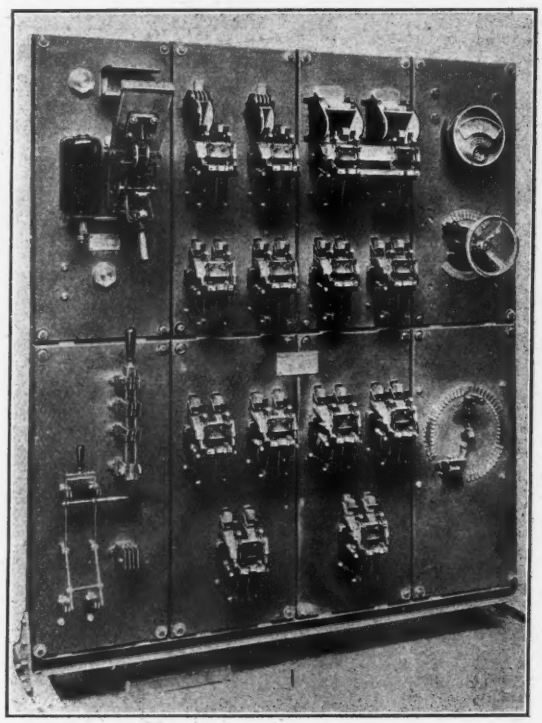


Fig. 1.—E.A. Co. 400 h.p. Multiple-Contact Starter.

initial contactor, so that if any of the intermediate contactors stick up, the first cannot close; the other contact introduces an economy resistance into the circuit of the solenoid. If, in starting up, one of the contactors fails to close, none of the subsequent ones can close, and in such a case the starting hand-wheel must be returned to the first position and a fresh start made. The resistances are of the iron grid type, and are mounted on the back of the board; the economy coils are all brought together in a frame where they are readily accessible, with neat wiring to the corresponding solenoids.

In order to stop the motor without loss of time, dynamic braking is employed, three resistance steps being provided on the upper position of the main knife switch. The board is intended for the control of a motor of 400 h.p., taking currents up to 1,500 amperes; the contacts are therefore very substantial, and carbon sparking contacts are provided on all the contactors. In addition, the initial and final contactors, which are the only ones that may have to break the circuit, are fitted with magnetic blow-outs. The switchgear was shown to us in operation, and appeared to be a very satisfactory job in all respects.

Westinghouse Liquid Controllers.

The advantages of liquid controllers have increased as their drawbacks have diminished, with improvements in construction, and the modern type differs widely from the crude apparatus formerly available, being now a well-designed and reliable machine, which lends itself admirably to a variety of conditions. We illustrate herewith a hand-operated controller of this kind which has been got out by the British Westinghouse Co., Ltd., of Trafford Park, Manchester, for use in connection with slip-ring reversing motors driving haulages, &c., in mines and quarries, for stator pressures up to 3,300 volts, stator currents up to 300 amperes, and rotor currents up to 750 amperes. The device comprises stator circuit oil-break switches, and liquid resistances for the rotor circuit, the latter being provided with a system of water-cooling pipes, as shown in section, fig. 3. The controller is operated with a lever, as shown in fig. 2, unless otherwise specified, and is so

arranged that the oil switches close before any of the rotor resistance is cut out of circuit; the switches are of heavy construction, and are suitable for frequent operation under heavy load. The arrangement of the resistance tank is shown in the section, fig. 3.

The fixed electrode can be removed without disturbing the earthenware pots. The electrodes are provided with a sump below

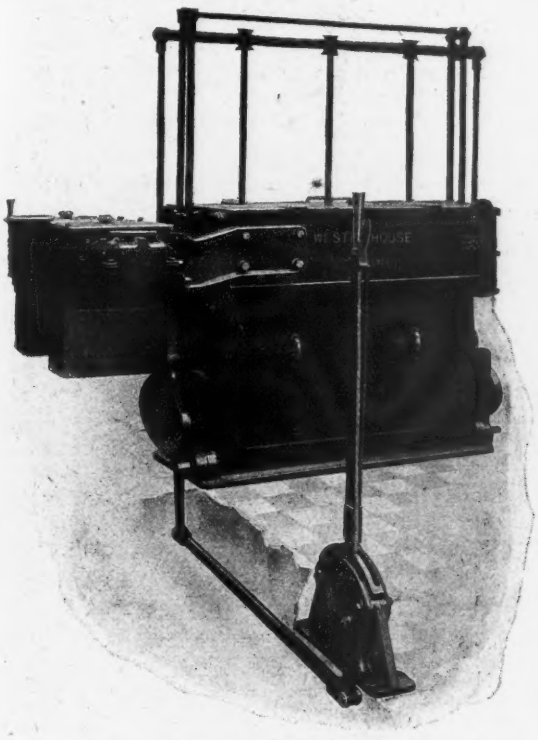


Fig. 2.—Westinghouse Liquid Controller.

the contact surfaces in which any sludge will collect, and from which the sludge can be drawn off by means of a cock. The earthenware pots can be withdrawn through the side of the controller, and new ones fixed in the same way, thus obviating the

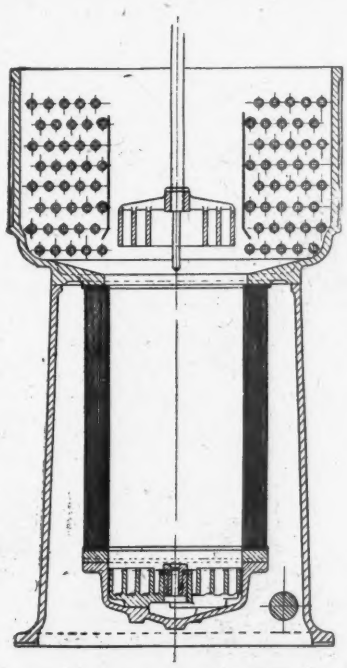


Fig. 3.—Section of Resistance Tank.

necessity of a pit below the controller for this purpose. The moving electrodes may be removed without disturbing the cooling pipes. Baffle plates ensure proper circulation of the electrolyte. The amount of water required is approximately 3·3 gallons per horse-power dissipated in the controller per hour.

ELECTRIC INCUBATORS.

The advantages of electricity for hatching and brooding chickens and testing eggs are becoming better and better recognised, and the convenience and adaptability of electric devices over those operated by gasoline, gas, steam, and kerosene easily place them in the front wherever electric service is available.

Among the advantages claimed for electric incubators are simplicity of operation, close control of both heat and moisture, perfect ventilation, absence of smoke, soot, fumes, and odours, safety with respect to danger from fire, &c.

The incubator shown in fig. 1 is of metal construction, the outside casing being of heavily-enamelled sheet steel, and the inside, or egg-chamber, of heavy galvanised iron. The dead-air space between the two is insulated with a sanitary, fireproof material. Ventilation is controlled from the outside by a metal slide in the bottom of the incubator, by means of which the intake of air can be easily and correctly regulated. The moisture or humidifying tank is on a flange attached to the side of the egg chamber, sliding in or out, and being easily accessible. The electric wiring is placed between the outer and inner metal parts of the removable top lid of the machine, so that nothing is exposed except the sockets for the bulbs and the circuit-breaker.

The egg trays are of heavy galvanised wire, and the sizes are graduated so that each tray will hold about 100 eggs, making the trays easy for anyone to handle. Where the dimensions permit, the egg trays are made in sectional squares, so that the positions of the eggs relative to the centre, sides, and corners of the container can be changed without actually touching the eggs themselves. Solid removable bottoms with perforated sheet and sliding ventilators are provided. In addition to the asbestos lining, the dead-air space in the top is packed with mineral wool, and the sides with a triple layer of prepared paper and felt. The machine is equipped with double-glass windows in the door, so that each part of the interior is always visible. A card slide is attached to the side of the machine for keeping records of the hatch.

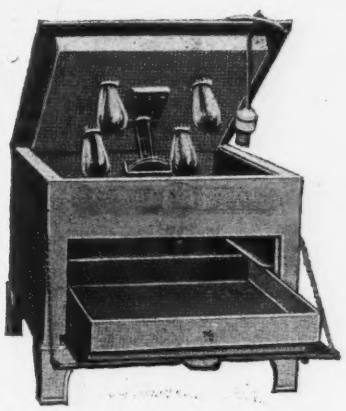


Fig. 1.—Electric Incubator with Capacity of 65 Eggs.

The temperature of the incubator is controlled by a thermostat, which automatically regulates and controls the degree of heat required in the incubator. When the temperature rises a quarter degree above the point at which the thermostatic circuit-breaker has been set, the circuit is automatically broken, and the current is shut off from the lamps, which are of carbon-filament type. As soon as the temperature falls a fraction of a degree below the point at which the machine is set, the circuit is automatically re-established.

At a rate of 5 cents a kw.-hour it is said to cost only a trifle more to hatch by electricity than by oil or hot water. Where the rates are much lower, the difference in cost is either eliminated, or the advantage can be placed on the side of the electrically-operated machine. It is claimed, however, that at the above-named price the small additional excess in cost is more than offset by the increased percentage of chickens hatched, the time saved over that spent in operating other devices for hatching and brooding, the absence of worry as to the outcome, and the superior vitality of the young fowls, together with the absolute lack of fire risk. The all-metal construction of the machine shown herewith permits it to be easily cleaned, and it is, therefore, far more sanitary than the old types of wood machines.

Of course, in producing chicks by artificial means the mere hatching of the eggs is only "half the battle." The chicks must be reared, and statistics show that only about one-half of the chicks hatched reach maturity. This large mortality is caused, it is claimed, by disease, usually the result of improper brooding. In the absence of the motherly hens to watch over the broods produced by artificial incubation, and especially to keep them warm at night, electrically-heated hovers have been developed, of similar construction to that of the incubator described above, being of metal, light in weight, portable, and perfectly insulated. A curtain of felt is employed for providing shelter for the chicks. No thermometer is needed, because the proper degree of heat necessary to rear the chicks is computed in advance, and the hovers are equipped with bulbs accordingly.—*Electrical World.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SWITZERLAND.—With reference to the notice published in the Review of January 28th, containing a list of electrical and other goods of which the Société Suisse de Surveillance Economique is the only authorised consignee in Switzerland, it appears that a revised list of articles has been issued by the War Trade Department, in respect of which licences for export to Switzerland are only granted if the goods are consigned to the above-mentioned Société for account of the ultimate consignees. Certain articles in the list are allowed to benefit under the special scheme for small parcels (details of which were published in the *Board of Trade Journal* of March 23rd); in these cases licences may, at the discretion of the War Trade Department, be issued on application without the production of a certificate from the Société, in respect of parcels up to 11 lb. in weight by non-postal service, provided that they are dispatched by the special route stipulated. The following are among the articles appearing in the revised list; those printed in italic type can take advantage of the special scheme above-mentioned, while in the case of those not printed in italics a certificate from the Société is essential:—

Accumulators, electric, and accumulator plates.
Aluminium in all forms and aluminium manufactures.
Asbestos, crude and manufactured.
Batteries, electric, and parts.
Bauxite.
Belting (machine) of all kinds.
Cable, insulated.
Carbons, electric. (*Carbons for electricity—except electrodes—and carbon brushes for dynamos, can be sent under the small-parcel scheme.*)
Celluloid, raw, in bulk, sheets, rods, tubes, clippings and waste (but not wares).
Chrome, ore and metal, in all forms.
Copper: Ore (including pyrites); pure metal and alloys of, in all forms; waste.
Corundum.
Detonators.
Electrical firelighters.
Electrical insulated wire and cables.
Electrodes, cells and component parts.
Emery, all forms, and emery wheels.
Ferro-chrome and ferro-nickel, and all other ferro-alloys.
Filings and scrap, of old copper, tin, zinc, and their alloys.
Fuses (miners').
Gloves (rubber).
Graphite.
Gutta-percha, all forms.
Instruments, nautical, observation, geodetical, and optical.
Lead, pure and its alloys; pipe; sheet, drawn and wire; lead ore; waste.
Machine tools and parts thereof.
Machinery (and parts) for use in marine and aerial navigation.
Machinery, electrical, electric dynamos, and motors.
Machinery, refrigerating.
Machinery oils
Magnetos.
Mercury; ore, metal, and preparations; fulminate.
Metal, anti-friction.
Mica, rough and worked.
Molybdenum; ore and alloys, also salts.
Nickel, ore, metal, pure and alloyed, all forms.
Packings, engine and boiler, including slagwool.
Rubber, vulcanised, in sheets.
Surgical instruments and apparatus.
Telegraphs and telephones, material for.
Titanium ore, metal and salts.
Tungsten in all forms.
Vanadium, ore, salts.
Vehicles of all kinds used in military or naval transport.
Zinc, ore; metal, pure and alloyed, in all forms.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

8,607. "Electrodes of secondary batteries." E. Hancock & H. Wintle. June 19th.
8,618. "Electric knitting needles." E. T. Bartlett & G. M. Simpson. June 19th.
8,620. "Electrical conductors." W. P. Granville. June 19th.
8,625. "Distributors for high-tension magnetos." G. S. Holland and Morgan Crucible Co. June 19th.
8,633. "Alternating-current commutator motors." British Westinghouse Electric & Manufacturing Co. June 19th. (U.S.A., June 19th, 1915.)
8,639. "Arrangement of electric storage batteries in submarines and construction of submarines for that purpose." E. C. R. Marks (Soc. Anon. Italiana G. Ansaldo & Co.). June 19th.
8,669. "Means for assisting adjustment of trolley-pole of tramcar, &c." R. Mercer. June 20th.
8,685. "Nozzle plugs." British Thomson-Houston Co. (General Electric Co., U.S.A.). June 20th.
8,691. "Telephone systems." O. Grahn, H. J. Herink & Relay Automatic Telephone Co. June 20th.
8,698. "Varying pressure in electro-magnetically-operated carbon-pressure regulators." Akt. Ges. Brown, Boveri et Cie. June 20th. (Germany, June 25th, 1915.)
8,732. "Electrolytically encasing wooden air-propellers." H. Watson. June 21st.
8,733. "Electric cable." C. J. Beaver & E. A. Claremont. June 21st.
8,736. "Electric circuit breakers." T. P. Casotti. June 21st.
8,740. "Protective devices for dynamo-electric motors." J. Anderson and G. Ellison. June 21st.
8,754. "Means for controlling and regulating electric motors." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). June 21st.
8,756. "Control of alternating electric current induction motors." W. Brooke. June 21st.
8,792. "Electro-magnet for localising foreign substances embedded in human body." J. Bergonie. June 22nd. (France, June 22nd, 1915.)
8,795. "Electrical systems for engines." W. A. Chryst & C. F. Kettering. June 22nd. (U.S.A., July 16th, 1914.)
8,796. "Controlling electric motors." British Thomson-Houston Co. (General Electric Co., U.S.A.). June 22nd.
8,797. "Electric lamps." E. Holden. June 22nd.
8,810. "Miners' electric safety lamps." O. Oldham. June 22nd.
8,811. "Battery lamp." N. Kribs. June 22nd.
8,814. "Electrical influence machines." D. K. Morris. June 22nd.
8,815. "Electrical precipitation of solid and liquid particles." D. K. Morris. June 22nd.
8,818. "Device for straining or tensioning wires, cables, &c." A. L. Reddup. June 22nd.
8,821. "Timing devices for telephone systems." H. J. Herink & Relay Automatic Telephone Co. June 22nd.
8,831. "Electrically-welded wire fabric, &c." British Reinforced Concrete Engineering Co. & E. B. Hall. June 23rd.
8,845. "Electro-magnetic relays." C. B. Burdon (Siemens & Halske Akt. Ges.). June 23rd.
8,858. "Varying resistance of electric circuit." Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). June 23rd.

PUBLISHED SPECIFICATIONS.

1915.

3,439. Sparking Plugs for Internal-combustion Motors. Soc. Industrielle de Delle. March 3rd. (May 8th, 1914.)
8,227. Magneto-electrical Generating Systems. F. A. Heys. (Neuland Magnetos, Ltd.) June 3rd.
8,235. Electrical Instruments of the Moving Coil Type. E. S. Heurtley. June 3rd.
8,326. Electric Welding, Brazing, and Soldering, and apparatus therefor. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 4th.
8,512. Electrical Heaters. E. C. R. Marks (Landers, Frary & Clark). June 8th.
8,572. Dynamo-electric Machines A. H. Neuland. June 10th.
8,702. Refractory Metal Tubes. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 12th.
8,739. Electric Apparatus for Driving Clocks. H. E. Warren & Warren Clock Co. June 14th.
8,829. Electric Heating and Resistance Devices. A. F. Berry. June 15th.
8,927. Wireless Telegraph Receivers. Marconi's Wireless Telegraph Co. and G. M. Wright. June 17th.
9,720. Wireless Signalling Systems. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 3rd.
9,993. Combined Locking Device and Shade Support for Electric Incandescent Lamps. W. C. Crockatt. July 9th. (December 30th, 1915.)
10,769. Crystal Detectors, particularly for Wireless Signalling. Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. July 24th.
12,617. Methods of Marking Glass. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 2nd.
14,230. Electrolytic Process for Removing Oxide from the Surfaces of Articles of Iron or Steel. P. Marino. October 7th.
16,671. Electro-dynamic Brakes for use in connection with Printing Machines. H. V. James. November 25th. (Addition to 596/15.)
16,692. Winding Drums for Electric Wires, Cables, and the like. H. F. Smithson and Callender's Cable & Construction Co. November 24th.
17,946. Automatic Selectors for Telephone Systems. Siemens & Halske Akt. Ges. December 23rd. (April 20th, 1915. Addition to 23,336/13.)

1916.

3,234. Dynamometers. W. G. Walker. March 3rd. Patent No. 100,556.

LIST OF BRITISH PATENTS EXPIRING DURING 1916.

(*Concluded from* **Vol. 78**, *page* 748).

18,672. August 28th, 1902. H. W. Cox. Electric switches.
19,562. September 6th, 1902. H. H. Lake. Brakes and electric switches.
20,755. September 23rd, 1902. O. Imray. Electric controllers.
21,090. September 27th, 1902. J. Gell. Telegraphs.
21,914. October 8th, 1902. H. H. Lake. Dynamos.
22,712. October 18th, 1902. V. A. Fynn. Electric motors.
23,262. October 24th, 1902. A. Blondel. Electric lamps.
23,288. October 24th, 1902. G. Winter & F. Eichberg. Dynamos; electric transformers; electric motors.
24,770. November 11th, 1902. G. H. Hill. Electric motors.
25,023. November 14th, 1902. G. A. E. Kohler. Electric motors.
25,240. November 17th, 1902. E. Tyer, F. T. Hollins & F. W. Leake. Railway signals.
25,524. November 20th, 1902. Soc. G. et P. de Mestral. Electric lamps.
25,658. November 21st, 1902. Marconi's Wireless Telegraph Co. & C. S. Franklin. Wireless telegraphy.
26,395. November 29th, 1902. A. Artom. Wireless telegraphy.
26,552. December 2nd, 1902. R. A. Fessenden. Wireless signalling.
26,553. December 2nd, 1902. R. A. Fessenden. Wireless signalling.
26,868. December 5th, 1902. A. Wright. Measuring electricity; electrolysis.
27,769. December 16th, 1902. E. A. Carolan. Electric switches and cut-outs.
27,897. December 17th, 1902. M. Pognon. Internal-combustion engines.
28,167. December 20th, 1902. H. G. Brown. Railway signals.